A Research in Adolescence

I. Pubescence and Physical Growth

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THIS is the first of a series of articles which will report some of the most important findings of a research in which two hundred adolescents were studied continuously over a period of years. The findings around specific aspects of the adolescent's growth, attitudes, and behavior are significant in themselves. When put together, the results of the study strongly suggest the need for a new formulation of adolescent psychology based on the facts yielded by investigations which employ the best accredited methods and techniques of current scientific procedure.

Some of the problems on which data are to be presented in this first article have received the attention of other studies. The results of this study merit report, however, if for no other purpose than to serve as a basis of comparison between the amount and the rate of change in physical aspects of growth and of change in personality and behavior factors during adolescence. Some of the findings, as those on the relation between motor coördination and pubescence, for example, rather definitely challenge, if they do not controvert, popular conceptions—as in this case, that of "adolescent awkwardness."

A brief general description of the investigation will provide a background against which the findings to be reported in this and the following articles may be understood, and interpreted more intelligently. The most salient facts about the study can be stated in summary fashion.

1. It is a study of "normal" boys, that is, of the every-day boy who is being dealt with by parents and by public schools and other social agencies.

2. It is a continuous study of the same two hundred boys over a period of years.

3. It employed a combination of techniques to yield data concerning physiological, physical, personality, and social factors and their interrelationships.

4. It used existing standard testing procedures in the main but developed a few new techniques, including a "friendship finder" for studying quantitatively the interaction of individuals within a group or social situation.[1]

PUBESCENCE AND GROWTH IN HEIGHT AND WEIGHT

That physical growth of many kinds is accelerated during pubescence is a

[1] The series of articles to appear in *Child Development* will report those findings of the total study which the editors have considered to be of particular significance for readers of this journal.

well established and commonly known fact. Studies are plentiful which show the spurt in height, weight, strength, chest circumference, vital capacity, and similar factors during the adolescent years. Practically all of these reports, however, merely show the increase in height, weight, etc., with age, and *infer the presence of puberty from the observed acceleration in growth.* These investigations find that the maximum growth of boys in height, for example, is around the fourteenth year. It is then assumed, since other studies have reported this to be the average age of puberty, that the rapidity of growth is to be associated with pubescent development.

Since the age at which boys reach pubescence varies greatly—from eleven to sixteen years for the boys in this study,—it is obvious that such data do not disclose the precise relation between pubescent change and physical growth. We shall present here findings of the following three kinds, all of which are definitely related to this specific problem.

1. A comparison of the height and weight of boys of the same chronological age but in different stages of pubescent development, namely, prepubescence, pubescence, and postpubescence. These findings indicate that *pubescent age, or status, is more important than chronological age in determining the individual's height and weight.*

2. A comparison of the amount of growth in height and weight for a one- and a two-year period for boys in different stages of pubescent development.

3. Facts which indicate the relation between the age at which a boy reaches puberty and the rate of his subsequent growth.

The measurements, tests, and examinations which yielded the data presented in this article were administered annually for three successive years. The measurement procedure followed those described by C. K. Taylor in *Physical Standards for Boys and Girls.*

To determine the pubescent status of the boy the criteria most commonly employed in other reported studies of pubescence were used. These criteria, frequently called the "Crampton criteria" because of the pioneer study conducted by Crampton early in the century, are as follows: (*a*) Prepubescence is the total period of life before there are any physiological signs of puberty; (*b*) pubescence is marked by the appearance of pigmented hairs in the pubic region; (*c*) post-pubescence is marked by a kink or twist in the pubic hair and a wrinkled scrotum (4).

These criteria are not so reliable in determining the pubescent status of a boy as would be the date of the first nocturnal emission, or microscopic evidence of the first secretion of spermatozoa. The latter method for ascertaining the pubescent status of boys was employed by Baldwin (1). Crampton (4) validated the criteria he employed, however, by some microscopic examinations of secretions and "in every case well formed and mobile spermatozoa made their appearance in the months of transition to postpubescence." In a recent study by West (7) at Springfield, Mass., it was demonstrated rather clearly that the pubic index is more reliable than either the axillary or mammary in

ascertaining the pubescent status of boys (7).

Height and weight in relation to pubescent status

The facts reported in figure 1 provide a comparison of the mean height measures of pre-pubescent, pubescent, and post-pubescent boys at various chronological ages. Figure 2 presents similar data for the weight measures.

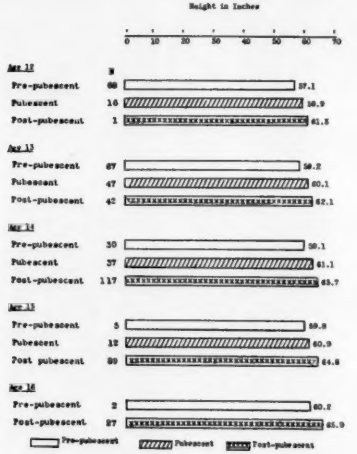


FIG. 1. COMPARISON OF MEAN HEIGHT MEASURES OF PRE-PUBESCENT, PUBESCENT, AND POST-PUBESCENT BOYS AT VARIOUS CHRONOLOGICAL AGES

The inaccuracy of assuming the presence of puberty from chronological age is evidenced in striking fashion. The impossibility of predicting or inferring physical growth from chronological age is also conspicuously apparent.

The foregoing figures indicate that the pubescent boy at twelve or thirteen is likely to be both taller and heavier than the boy two years older who is still pre-pubescent. The average age of the boys in each of the 3 pubescent classes in each chronological age group is approximately the same. The post-pubescents average about one-half month older than the pre-pubescents. The differences in height and weight which accompany different stages of growth are marked in the fourteen- and fifteen-year-old groups. At fourteen the post-pubescent boy exceeds the pre-pubescent of the same chrono-

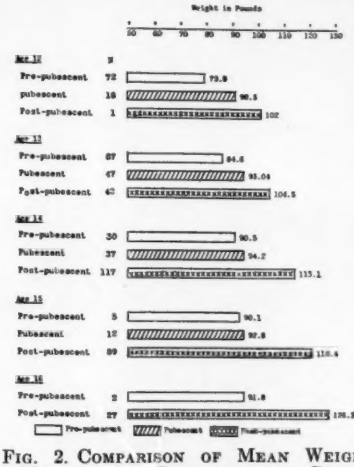
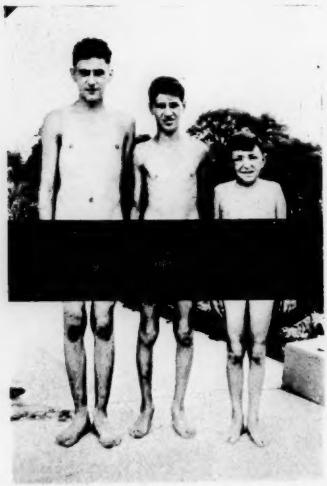


FIG. 2. COMPARISON OF MEAN WEIGHT MEASURES OF PRE-PUBESCENT, PUBESCENT, AND POST-PUBESCENT BOYS AT VARIOUS CHRONOLOGICAL AGES

logical age by over four and a half inches in height and almost 23 pounds in weight. Most conspicuous of all are the differences among the fifteen-year-olds. Even though the number of pre-pubescents is small here the data for the pubescent boys bring support to their creditability. The post-pubescent boy at fifteen, on the average, is 5 inches taller and 29 pounds heavier than the boy of the same age who is not yet pubescent.

As will be shown later, this difference is not due entirely to pubescent change. It may be concluded that the chronological age of a boy tells little about his physical status. In fact, it may tend to be misleading, because of the popular tendency to assume that a boy is pubescent at a certain age and then to make judgments about him based on this precarious assumption.



A CONCRETE ILLUSTRATION OF THE FINDINGS SHOWN IN FIGURES 1 AND 2

These boys are all fifteen years of age but are in different stages of pubescent growth. The boy on the left is post-pubescent (P_3); the one in the middle pubescent (P_2), and the one at the right is pre-pubescent (P_1).

Growth in height and weight in relation to pubescent change. We next present the materials which show more definitely the differences in the amount of growth which accompany different stages of pubescent status and change during a one- and two-year period. There are 6 groups or classifications of pubescent status and change:

1. Boys who remain pre-pubescent for the period, the symbol for which is P_{1-1}.

2. Boys who change from pre-pubescence to pubescence during the period, the symbol for which is P_{1-2}.

3. Boys who are pubescent at the beginning and the end of the period, the symbol for which is P_{2-2}.

4. Boys who change from pre-pubescence to post-pubescence within the period, the symbol for which is P_{1-3}.

5. Boys who change from pubescence to post-pubescence within the period, the symbol for which is P_{2-3}.

6. Boys who are post-pubescent at the beginning and the end of the period, the symbol for which is P_{3-3}.

ANOTHER ILLUSTRATION OF THE FINDINGS PRESENTED IN FIGURES 1 AND 2

The chronological ages of the boys are in inverse order to their physical size. The boy at the left is 13 years and 1 month old, and post-pubescent (P_3); the boy in the middle is 13 years and five months old, and is pubescent (P_2). The boy at the right is 14 years and 6 months of age, and is pre-pubescent (P_1).

The increase in height and weight for one year's growth that accompanies the different stages of pubescent status and development is reported in figures 3 and 4. The average growth for boys from twelve to fifteen years of age who remain pre-pubescent for a year is 1.8 inches and 7.6 pounds. This is the smallest amount of growth for any of the six possibilities in the pubescent development portrayed by the figures. The change from pre-pubescence to pubescence (P_{1-2}) during the year resulted in the second smallest amount of growth for both height and weight. The most rapid

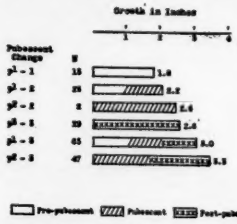


FIG. 3. INCREASE IN HEIGHT FOR ONE YEAR WITH PUBESCENT CHANGE

physical growth comes during the shift from pubescence to post-puberty (P_{2-3}). During the year the boy enters post-pubescence he puts on twice as much weight and increases almost twice as much in height as the boy who remains pre-pubescent for a similar period.

The cases of boys who remain pubescent for a year (P_{2-2}) without reaching post-pubescence are few, but they do suggest that an acceleration of growth accompanies pubescence even though post-puberty is not achieved within the year. It should be noted that only 15 per cent of the pubescent (P_2) cases remain in that stage for a year. The growth that follows post-puberty averages a little more than that for boys who remain pubescent.

The fact that change from pre-pubescence through puberty into post-pubescence (P_{1-3}) in a year does not result in quite as much increase in height and weight as does the shift from pubescence to post-puberty (P_{2-3}) in the same length of time seems to call for interpretation. The reason for this can be understood by noting that growth in the P_{1-1} period is less rapid than for any stage after pubescence has been attained. Part of the time, therefore, the growth of the boy

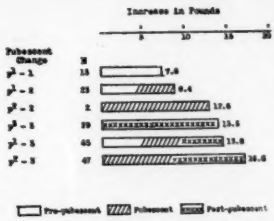


FIG. 4. INCREASE IN WEIGHT FOR ONE YEAR WITH PUBESCENT CHANGE

who travels the range from pre-pubescence to post-puberty within a year is taking place at the least rapid rate. An examination of facts not reported here shows, further, that the growth of the boys who passed from pre-puberty to post-pubescence in a year was more rapid in both height and weight in the subsequent year than that of the boys in the P_{2-3} category. We interpret this to mean that the period which immediately precedes and follows the attainment of post-pubescence is accompanied by rapid growth.

Figures 5 and 6 display graphically the findings on two years growth in

height and weight in relation to pubescent status.

These data provide some additional knowledge of the relation between pubescence and growth rates. The boys who remain pre-pubescent for two years still show the least gain in weight but those who have reached the post-pubescent stage have the least gain in height; probably the differences are not significant, however, between the P_{2-2} and the P_{1-1} cases. If these differences were significant, they would suggest that acceleration of growth in weight tends to continue longer than acceleration of growth in height.

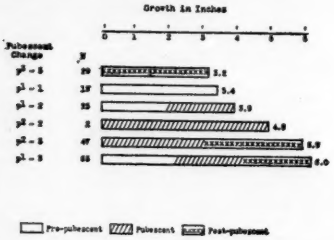


FIG. 5. AMOUNT OF GROWTH IN HEIGHT FOR TWO YEARS WITH PUBESCENT CHANGE

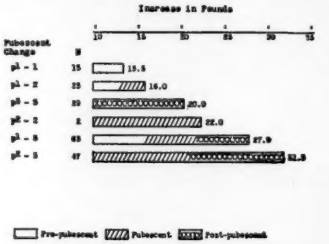


FIG. 6. AMOUNT OF GROWTH IN WEIGHT FOR TWO YEARS WITH PUBESCENT CHANGE

There are only 2 cases of boys who remain in the pubescent status for two years; consequently, any conclusion made would be precarious. Their growth in height and weight happens to be greater than that for the boys who are either pre-pubescent or post-pubescent for the two years. This seems to be consistent with the other findings, which imply that the least growth takes place in the pre-pubescent stage and the most rapid growth during the transition from pubescence to post-pubescence. It might be a fair "guess" that since these boys have been pubescent for two years post-pubescence is not far away. The boys who change from either pre-pubescence or puberty to post-pubescence during the two years more than double the weight increase of those who do not reach puberty. The increase in height for these boys in two years, as for the one-year period, is not quite twice as much as it is for those who remain pre-pubescent.

All of these findings are based on averages and tend to obscure the individual variations from these averages, which, of course, are very important. We have been looking for generalizations about the trend, however, and on that basis only is there justification for depending entirely on averages in making this report.

Pubescence and per cent increase in height and weight. The foregoing data and discussion are based on actual increments of growth in height or weight without taking account of the size of the boys at the time of their first measurement. Some students of physical growth problems believe that the rate of growth is most accurately ascertained when the calculations represent the per cent of gain over the original measurement. We have treated our height and weight data for

the one-year growth period in this way. The results may be scrutinized in table 1 and figure 7. They indicate that the 6 pubescent categories have about the same relative significance for growth whether the growth measures are based on actual increments or per cent of increase. What stands out most conspicuously when figure 7 is examined is that the growth in weight is nearly three times as fast as that in height when calculated on the basis of per cent of increase.

TABLE 1

Per cent increase in height and weight for one year with pubescent change

PUBESCENT CHANGE	N	HEIGHT			WEIGHT		
		Mean in inches	Mean gain	Per cent gain	Mean in pounds	Mean gain	Per cent gain
P_{1-1}	54	57.0	1.8	3.1	80.0	6.0	7.5
P_{1-2}	43	57.7	2.2	3.8	80.9	8.5	10.5
P_{1-3}	38	58.3	3.6	5.1	85.9	13.6	15.8
P_{2-2}	14	59.4	2.6	4.4	84.8	11.7	13.8
P_{2-3}	63	60.1	3.3	5.5	92.2	16.4	17.8
P_{3-3}	118	63.0	2.4	3.8	110.6	13.2	11.9

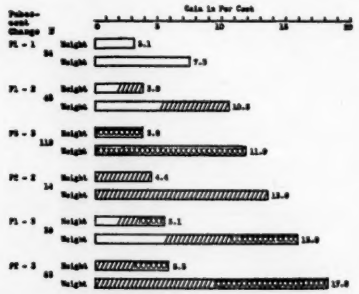


FIG. 7. PER CENT INCREASE IN HEIGHT AND WEIGHT FOR 1 YEAR WITH PUBESCENT CHANGE

INFLUENCE OF AGE ON PHYSICAL GROWTH

We next come to the question of whether or not the amount of physical growth that accompanies a particular shift in pubescent status is relatively constant regardless of the age of the boy. The number of cases in the study, when spread over the 6 possible pubescent categories for each chronological age from twelve to sixteen, is small, so we must depend largely upon the consistency of the results for our judgments as to their dependability. Our findings bearing upon this problem have been organized in figures 8 and 9.

We may swiftly summarize the conclusions which the facts reported by figures 8 and 9 suggest. Growth in height and in weight is approximately the same for the twelve- and the thirteen-year-old pre-pubescent boy. It probably tends to become less as a boy becomes older if he remains pre-pubescent. That is about all that can be assumed in view of the small number of cases in the fourteen- and fifteen-year-old groups. The shift from pre-pubescence to puberty evidently brings a slower growth in both height and weight for the boy at twelve than for the thirteen- and fourteen-year-old boy. The growth figures are 1.8, 2.4, and 2.2 inches and 7.2, 9.6, and 8.3 pounds, respectively, for a

year. The number of boys who stayed in the pubescent class for a year with no physiological change is too small to warrant conclusions, but it may be noted that the increase in height and weight is greater than where the boy remains pre-pubescent or shifts from pre-pubescence to puberty. The amount of growth that accompanies the change from P_2 to P_3 is approximately the same for twelve-, thirteen-, and fourteen-year olds, the amounts being 3.1, 3.4, and 3.2 inches and 15.8, 17.4, and 15.6 pounds, in this order. These findings are at variance with the conclusions of other investigators to the effect that growth is more rapid and intense when pubescence is attained early.

There is apparently, however, a tendency for the older boys to gain less in height than the twelve-year-old group when the shift from pre-pubescence to post-pubescence takes place in a year. The amount drops consistently, running 3.3, 2.9, and 2.5 inches for the twelve-, the thirteen-, and the fourteen-year-old classes, respectively. The older boys apparently compensate for this smaller gain by maintaining a higher growth rate in the following two or three years. The evidence for this is not included in this report. Our findings are similar to those secured in a much more exhaustive study on this point reported by Boas (2). The age at which the growth spurt comes does not materially affect adult stature; that is, the growth curve tends to flatten out sooner when acceleration is early than when it comes later in adolescence. The tendency in the weight data reverses

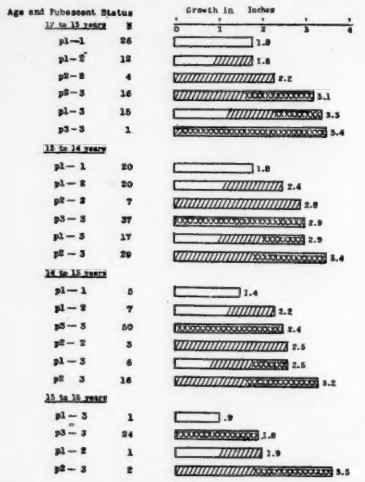


FIG. 8. GROWTH IN HEIGHT FOR 1 YEAR WITH PUBESCENT CHANGE FOR BOYS OF DIFFERENT CHRONOLOGICAL AGES

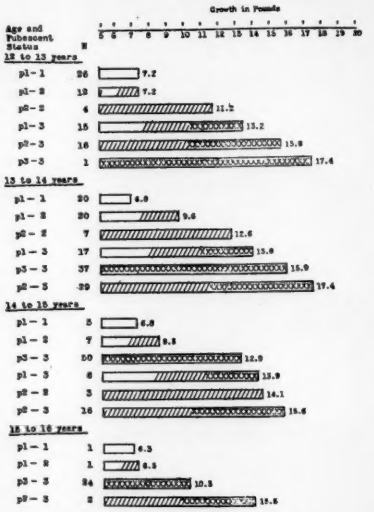


FIG. 9. GROWTH IN WEIGHT FOR 1 YEAR WITH PUBESCENT CHANGE FOR BOYS OF DIFFERENT CHRONOLOGICAL AGES

that of the findings on height. The increments of gain in weight for the transition from pre-pubescence to post-pubescence are slightly larger.

Evidence from correlations

Table 2 presents correlations of pubescent status and of chronological age with height and weight. The correlations are smaller than they would be if the cases were less homogenous. If the age span were five to twenty, for example, instead of twelve to sixteen, the resulting correlations would probably be considerably higher. It will be observed that pubescent status correlates more highly with height and weight than does chronological age. The formula used for the correlations of pubescent status with the other measures was suitable for the correlations of a qualitative with a quantitative series (5). Partial correlations are considered by some of our statisticians to be very precarious but with this caution they are also shown in table 2. If dependable, the association between pubescence and height and weight stands out a little more clearly.

In view of the facts displayed in figures 1 and 2, a greater discrepancy between the correlations of pubescence and of chronological age with height and weight would be expected. The explanation of this situation seems to lie, in part, in the fact that the height and weight measures represent the total growth (or life span) of the individual at the time of measurement rather than merely the amount of growth for a one- or a two-year period within which differences accompanying pubescent development show up more sharply. This can be made more concrete by illustration. Let us assume that 2 pre-pubescent boys are 60 inches tall at 13, and that one becomes post-pubescent while the other remains pre-pubescent during the following year, with a corresponding growth of 4 and 1.5 inches, respectively. The growth differences are relatively great, but the difference between 64 and 61.5 is not nearly as substantial. It is this second kind of difference, however, which shows up in these correlations. The association between actual growth measures and pubescent change would be much greater.

TABLE 2

Correlations of pubescent status and chronological age with height and weight

	r
Pubescent status and height	.54
Pubescent status and weight	.55
Age and height	.51
Age and weight	.52
Pubescent status and height, with age constant	.37
Pubescent status and weight, with age constant	.39
Age and height, with pubescent status constant	.32
Age and weight, with pubescent status constant	.32

SUMMARY OF CONCLUSIONS

From the foregoing findings the following conclusions may be summarized:

1. *Pubescent status cannot be inferred from chronological age.* The chronological age of the individual during the "adolescent" years is not a trustworthy index of pubescent status.

2. The differences in the height and weight of boys of the same chronological age but of different pubescent status are approximately as great as those between boys two years different in age but of the same pubescent status.

3. The most rapid growth in height and weight comes in the year during which the boy passes from pubescence to post-pubescence. This is true whether actual growth or per cent increase measures are employed. It also tends to be true regardless of age within the range of thirteen to fifteen.

STRENGTH AND MOTOR ABILITY IN RELATION TO PUBESCENCE

All sorts of notions have been current concerning the physical capacity and the motor coördination of the adolescent boy. A frequent assertion is that the strength of the rapidly-growing adolescent is not commensurate with the new proportions of his physical stature. Some writers assert that although the maximum strength may be there potentially the point of fatigue is likely to be quickly reached. A rather common explanation of "laziness" in the adolescent boy is in terms of an enlarging physical frame not yet come under adequate muscular and nervous control. What is perhaps the most common stereotype is the assumption that physical awkwardness and clumsiness are characteristic of the swiftly-growing adolescent. Because his bone structure and frame have outgrown his muscular control he has been described by many writers as being like a person "walking on stilts."

The question of the accuracy of these popular conceptions was only a secondary consideration, however, in in the employment of a battery of physical strength, or capacity, tests and a battery of motor coördination tests in the annual physical measurement of the boys in this study. Evidence as to their trustworthiness was secured incidentally as data concerning such basic concerns as the following were being secured: the rate of development in physical strength and motor ability during adolescence; the relation of these two elements to pubescent development as well as to chronological age; the relation between growth in such elements as height and weight and the accompanying changes in physical capacity and motor ability.

First, we shall review the findings yielded by the physical capacity tests. Then we shall present a rather comprehensive set of facts concerning motor ability in relation to pubescent and physical development.

Pubescence and strength

The tests used for the measurement of physical strength were those standardized by Rogers (6). In order that the reader may clearly understand the kind and extent of physical strength, or capacity, which was being measured, it is desirable to describe the tests and their method of scoring. There were 7 tests, involving the use of 5 pieces of apparatus designed to measure vital capacity and the strength of the larger muscles. The factors tested and the tests used were:

1. *Lung or breathing capacity*, commonly termed vital capacity, measured

with a spirometer. Each boy had 2 trials, the better of the 2 being recorded in cubic inches.

2 and 3. *Strength of grip*, or forearm, of both right and left hands, was measured by squeezing a hand-dynamometer. The best achievement for the two attempts with each hand was recorded in pounds.

4. *Strength of back* was measured by the number of pounds that could be lifted by the back muscles as registered on a back and leg dynamometer (frequently styled a "back and leg lift machine"). Only one trial was given, since it has been demonstrated that the maximum lift is generally the first one.

5. *Strength of legs* was measured by lifting with the leg muscles on the back and leg dynamometer, carrying the weight on the thighs. This score also was recorded in pounds.

6. *Strength of arms and shoulder girdle, in extension*, was measured by the number of "push-ups" the boy could accomplish from a prone position on the parallel bars.

7. *Strength of arms and shoulder girdle, in flexion*, was measured by the number of "pull-ups" or "chinnings" the boy could do, holding eight-inch rings suspended from an overhead ladder. Since weight and height are conditioning factors in both "push-ups" and "pull-ups," the scores for these two tests took these factors into account.

This battery of tests yields a measurement or appraisal of a boy's vital capacity and of the strength of his grip, arms, shoulders, legs, and back. Some of the events required merely a maximum single effort, such as the back and leg lift tests; others, such as "the chinning" and "the push-ups," involved the elements of endurance and fatigue.

The scores on all of these 7 tests were combined to form a single measure, or index, of physical capacity, or strength. The elements which enter into this total score will need to be kept in mind, as the combined score rather than individual scores will be used in reporting the results. It may give further meaning to this physical capacity score if we add that Rogers found a substantial correlation, an r of .81 between the physical capacity

TABLE 3

Physical capacity measures of 553 boys by average age

	AVERAGE AGE					PER CENT INCREASE
	12	13	14	15	16	
	N					
	88	155	179	105	26	
Total physical capacity scores	666	807	986	1130	1241	86
Vital capacity	150	175	200	223	240	60
Strength of back	163	176	204	227	253	55
Pull-ups	1.1	2.7	3.9	4.8	5.5	400

score and an athletic index based on the achievement of high school students in standard athletic events.

The increase of strength with chronological age as measured by these seven tests is exhibited in table 3. The total score jumped from 666 for twelve-year-old boys to 1241 for sixteen-year olds, an increase of 86 per cent. In no other physical measure was the growth as rapid for this four-year period. It will be observed from table 3 that the rate of increase varied greatly with the specific tests which entered into the total measure. Strength of back, for example, as measured by the amount lifted with the back on the back and leg dynamometer showed an increase of 55 per cent. In the "pull-ups" or "chinnings," the sixteen-year-old boy does 5 times the number of the twelve-year olds, an increase of 400 per cent.

While the precise relationship of physical capacity with pubescent development is not revealed by these data, it can be concluded, since most of the twelve-year-old boys are pre-pubescent and practically all of the sixteen-year olds are post-pubescent, that physical strength is almost doubled in the four-year span during which most boys shift from pre-puberty to post-puberty. The correlation of physical capacity with age is .59, which is higher than that of age with height or weight.

Strength in relation to pubescent status and change. The scores of the boys for the three annual tests in physical strength according to age and pubescent status are given in figure 10. Comparison with figures 1 and 2, showing similar data on height and weight, are valuable here. The post-pubescent boy at 13 is stronger, as well as taller and heavier, than the pre-pubescent two years older. But the pubescent boy at 12 and 13 does not show the superiority in physical capacity over the pre-pubescent boy two years older as he does in height and weight. This fact suggests the hypothesis, which other data will bear upon more directly, that acceleration

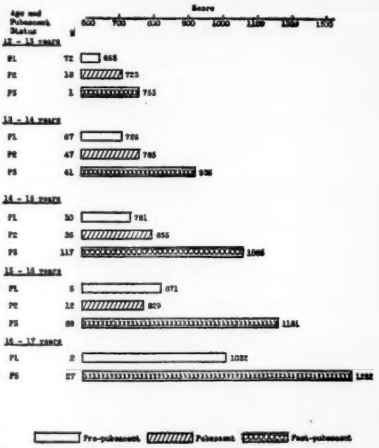


FIG. 10. COMPARISON OF PHYSICAL CAPACITY SCORES OF PRE-PUBESCENT, PUBESCENT, AND POST-PUBESCENT BOYS AT VARIOUS CHRONOLOGICAL AGES

in physical strength lags somewhat behind the spurt of growth in height and weight.

Increase in strength in relation to pubescent status and change. Several inferences or conclusions may be drawn from figure 11, which gives the increase in physical strength for one year with various categories of pubescent status and change. (1) The development of physical capacity is more than twice as rapid for a year in the P_{2-3} and

the P_{3-3} categories as for a similar period during pre-pubescence (P_{1-1}). (2) The change from pre-pubescence to puberty (P_{1-2}) is accompanied by what appears to be a smaller increase in strength than the increase in height and weight for the same period. See figures 3 and 4. (3) The most marked increase in physical capacity comes with the first year after the post-puberty stage has been reached. Since the most rapid growth in height and weight accompanies the shift from pubescence to post-pubescence, we conclude that the most rapid maturing of strength *follows rather*

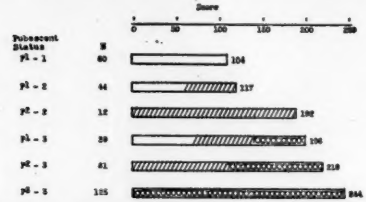


FIG. 11. INCREASE IN PHYSICAL STRENGTH FOR ONE YEAR WITH PUBESCENT CHANGE

than parallels the period of greatest growth acceleration.

Figure 12, which provides similar evidence for a two-year span of growth, supports in every respect the preceding conclusions. The fact that there is a greater increase in physical capacity for the P_{2-3} change than for two years at the post-pubescent level (P_{3-3}) is interpreted to mean that the second year of post-pubescence does not bring as conspicuous an increase in strength as does the first post-pubescent year. Other evidence showing a comparison of strength increase for the first and second years following post-puberty reveals this fact even more definitely.

In forming conclusions about physical strength and capacity of the adolescent from these facts a great deal depends upon the weight we give the tests employed as valid measures of strength. The combination of tests used appear to be adequate measures of the various elements involved in physical strength and capacity, including the factor of fatigue. We may state, therefore, with some degree of assurance, if not of decisiveness, that the physical strength of the boy who is passing through pubescence greatly exceeds that of the pre-pubescent both actually and in rate of increase. While it is not true that the adolescent

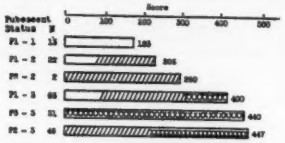


FIG. 12. INCREASE IN PHYSICAL STRENGTH FOR TWO YEARS WITH PUBESCENT CHANGE

boy is likely to be below par in strength in comparison with pre-pubescents of the same age, it is true that the sixteen-year-old post-pubescent, for example, may not possess the strength of the twenty-year-old of the same height and weight. In fact, the pubescent boy is likely to suffer in comparison with older persons of the same physical size. This statement is based on Roger's norms. This may partially explain the common impression that the rapidly growing boy does not have the strength and endurance commensurate with his size. He probably does not have the strength and endurance of adults of his own size. There is, evidently, throughout the

growth of the adolescent a lag in strength which is behind the potential strength of his physical frame.

PUBESCENCE AND MOTOR ABILITY

We turn now to the evidence bearing on the problem of what happens to the motor ability and coördination of the boy during the time of his pubescent development. A brief description of the tests used to measure motor ability will serve as background for interpreting the meaning of the results.

The tests employed were those developed and standardized by Brace (3). Twenty tests, chiefly of a stunt character, involving motor skill constituted the battery. The tests ranged in difficulty from such simple stunts as walking a few steps "toe to heel" on a straight line to extremely difficult feats of coördination and balance, such as jumping into the air, clapping the feet together twice, and landing with the feet apart. The coördinations called for by the tests were those considered basic in motor ability, and included a fair sampling of such elements as agility, balance, control, flexibility, and strength. That these tests measured something quite different from strength as measured by the Roger's test is apparent from the low intercorrelation of these two measures, which was .14.

Motor ability and age

It is immediately apparent from table 4 that motor ability as measured by the Brace Test does not increase with age during adolescence as swiftly as does physical capacity. The average score for the 12-year-old boy is 45, which means that he passed ten of the twenty tests. The average number of tests done successfully by the sixteen-year-old is thirteen, with an average score of 55. The increase in motor ability for the four years is 22 per cent, and in physical strength, 86 per cent. The correlation of age with motor ability (.16), when compared with the other physical measures, is further evidence that we are dealing with a type of abilities, or skills, that do not develop rapidly with chronological age during the adolescent years. Conceivably, this fact might be associated with the development of pubescence. The gain in motor ability with age is even less if there is any increase due to the "practice effect" which might be present in the second and third tests, each given at yearly intervals.

TABLE 4

Motor ability scores of boys twelve to sixteen years of age

AGE					AVERAGE INCREASE PER YEAR	PER CENT INCREASE
12	13	14	15	16		
N						
90	152	176	99	26		
45.6	49.5	50.9	52.0	55.8	3.4	22

Motor ability and pubescent status. We approach, then, more specifically the problem of the effect of puberty, with its rapid physical development, upon motor coördination. Do the results of our study support the common notion that physical growth outruns neuro-muscular control, with awkwardness and clumsiness the almost inevitable results? We have treated our data bearing upon this

issue in four ways and shall review the results in the following order: (1) The motor ability scores of boys of the same age but of different pubescent status will be compared. (2) The growth scores in motor ability for one- and two-year periods for boys in each of the various categories of pubescent change will be presented. These data will indicate the pubescent stages in which the greatest and the least amounts of gain in motor coördination take place during one- and two-year

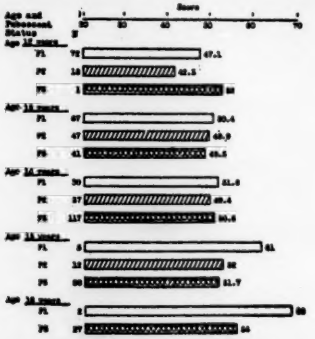


FIG. 13. COMPARISON OF MOTOR ABILITY SCORES OF PRE-PUBESCENT, PUBESCENT, AND POST-PUBESCENT BOYS AT VARIOUS CHRONOLOGICAL AGES

periods of growth. (3) We shall compare the *change* in motor ability scores for one- and two-year periods of boys who showed the *greatest increase in height and weight* with those who showed the least. (4) The correlations of motor ability with pubescence and other physical measures will be given.

Figure 13 presents graphically the mean scores of approximately 188 boys in the three annual tests of motor ability. We at once observe that the pubescent and post-pubescent boys have a lower score than the pre-pubescent boys at every age level. This excludes the one case of post-pubescence at 12 years of age. This difference is not large, except between the pubescent and pre-pubescent boy at twelve, but even the slight difference suggests the possibility of a general slowing up in the achievement of motor control with the arrival of puberty. An alternative to the interpretation of a general retardation of growth in motor ability with pubes-

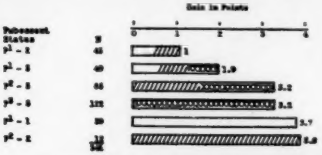


FIG. 14. INCREASE IN MOTOR ABILITY FOR 1 YEAR WITH PUBSCENT CHANGE

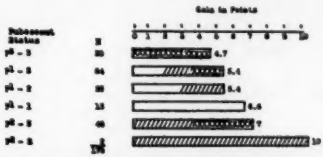


FIG. 15. INCREASE IN MOTOR ABILITY FOR 2 YEARS WITH PUBSCENT CHANGE

cence might be the possibility that there is a sufficient loss in the motor ability of enough boys to reduce the average for the total group. Further evidence in this report will bear upon these possibilities.

Change in motor ability with change in pubescent status. The mean growth in motor ability for one- and two-year periods for each of the 6 possible pubescent categories is given in figures 14 and 15. The interpretation of the results in the main is not difficult. (1) From figure 14 we would judge

that during the year in which the boy reaches puberty there is some increase in motor ability, as represented by the score "1," but it is only about one-third as much as for a year's growth either before or after puberty is reached. The question may arise here whether this difference is one of chance or of genuine importance. To answer this question the necessary statistical work was done in comparing the scores for the P_{1-2} group with those for the P_{1-1} group. The difference in means is only 2.6 times as great as the probable error of this difference, but even this ratio means that the probability is about 98 in 100 chances that the 2 groups are genuinely differentiated. The increase of 1.9 for the group who change from pre-pubescence to post-pubescence we interpret to mean that the development in motor capacity is slow around the pubescent stage, with a possibility of a faster development from pubescence to post-puberty. (2) The meaning of the findings for the two-year period as portrayed by figure 15 is not as clear. In general, the conclusions formulated from the data on one year's growth are reinforced. The two-year period during which the boy passes from pre-pubescence to puberty or to post-puberty is accompanied by the least improvement in motor coördination, with the exception of the two-year period on the post-pubescent (P_{3-3}) level. In the light of the increase of 3.2 for a single year after the post-pubescent stage has been reached, it is not easy to account for the increase of 4.7 for two years unless we assume that there is a substantial reduction in the rate of development in the second year of post-puberty.

We may assume from the foregoing facts that during the months around the time the boy reaches pubescence there is a slackening in the rate of increase of motor ability, but two facts should be clearly noted: (1) that *there is still improvement in motor ability, though it is less than before or after puberty;* (2) that *this is not the period, but precedes the period of the most rapid growth in height and weight.*

The findings shown in figure 14 do not indicate, however, whether the smaller gain in motor ability for the year in which puberty is reached represents an actual loss in motor ability coördination for some boys and a substantial gain for others or primarily a general reduction in the rate of gain for all. An analysis of the evidence on this problem not included in the report reveals the fact that the year during which pubescence is attained (P_{1-2}) about ten per cent fewer boys show any improvement than in the other stages of pubescent development.

Motor ability in relation to the amount of growth in height and weight. We shall now deal more directly with the question of the effect of rapid physical growth on motor coördination. The popular assumption has been that awkwardness in the adolescent boy is primarily the result of his rapid growth, that the more rapid the increase in height and weight the greater resultant clumsiness is likely to be. The large "overgrown" boy especially has been notoriously clumsy—in popular opinion. If this were true, we would expect the change from pubescence to post-pubescence to be paralleled by the least improvement, or greatest loss, in motor coördination, since that is when there is the greatest

acceleration in height and weight. This does not happen to be the case, however, in general at least, since the shift from pre-pubescence to puberty was seen to be the most crucial in its influence on motor ability.

As a more direct method of attack on this particular problem of the relation between rapidity of growth and motor coördination we studied the cases in the upper and lower quartiles of growth in height and weight and compared their change scores in motor ability. The results may be reviewed in table 5 and figure 16. The differences in the average change scores in motor ability for one year between the boys who showed the most and those who had the least growth in the same period is not significant. The boys who average a gain of 3.5 inches and the boys who average 18.8 pounds of growth in a year gain as much in motor ability, on the average, as do the boys who grow about an inch or gain five five pounds. Similarly, for the two-year period the boys who grow most rapidly in height and in weight, eight inches and forty pounds in some cases, improve as much in motor ability, on the average, as do the boys who grow but an inch or two in height and eight or ten pounds in weight. The increase in motor ability for the upper quartile group in height for 2 years, while not as great as for the lower quartile does not appear to be significantly different.

These findings seem to controvert rather convincingly the notion that marked physical growth is accompanied either inevitably or generally by disintegration of motor control. We present, however, the evidence shown in table 6 for a more detailed examination. These data are further supported by an analysis of other facts which indicate that as large a *per cent* of boys in the upper quartile of growth in height and in weight show a gain

TABLE 5

Comparison of mean change scores in motor ability of cases in upper and lower quartiles of growth in height and weight for one and two years

	UPPER QUARTILE			LOWER QUARTILE		
	N	Mean growth	Motor ability growth	N	Mean growth	Motor ability growth
Height—1 year	85	3.5 in.	3.4	93	1.2 in.	2.0
Height—2 years	45	6.5 in.	4.9	49	2.7 in.	6.2
Weight—1 year	89	18.8 lbs.	2.5	89	4.3 lbs.	2.6
Weight—2 years	42	35 lbs.	5.9	44	10.3 lbs.	5.9

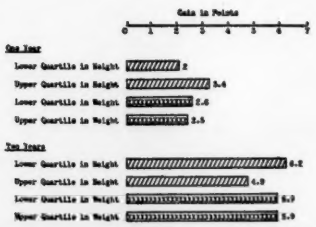


FIG. 16. COMPARISON OF MEAN CHANGE SCORES IN MOTOR ABILITY OF CASES IN UPPER AND LOWER QUARTILES OF GROWTH IN HEIGHT AND WEIGHT FOR ONE AND TWO YEARS

in motor ability as in the lower quartile.

It may be, of course, that the Brace test of motor ability does not measure the kind of "awkwardness" which has been implied in the traditional concept. However, a standardized test, including twenty samples of performance which involved the elements of balance, agility, control, and other aspects of coördination, surely furnishes a more trustworthy guide than the impressions of uncontrolled observation.

Evidence from correlations

The final set of evidence bearing on the relation of pubescence and motor coördination comes from the correlation technique. In table 7 the correlation of change scores in motor ability with change measures in other physical factors may be reviewed. It will be observed that there is no significant association between the amount of change in motor ability and the amount of growth in height, weight, or physical capacity.

TABLE 6

Distribution of change scores in motor ability of cases in upper and lower quartiles of growth in height and weight for one and two years

AMOUNT OF CHANGE IN MOTOR ABILITY SCORE	ONE YEAR				TWO YEARS			
	Growth in height		Growth in weight		Growth in height		Growth in weight	
	Upper quartile	Lower quartile	Upper quartile	Lower quartile	Upper quartile	Lower quartile	Upper quartile	Lower quartile
24– 29						1	1	1
18– 23	1	1	2	1		2		1
12– 17	11	11	9	12	10	8	10	8
6– 11	20	19	20	17	12	14	9	9
0– 5	31	33	32	35	14	18	14	22
−6– −1	14	21	15	16	6	4	6	1
−12– −7	6	4	7	3	3	2	2	2
−18–−13	2	4	4	5				
N.....	85	93	89	89	45	49	42	44

TABLE 7

Correlations of change scores in motor ability with change scores in other physical measures

MOTOR ABILITY WITH	ONE YEAR	TWO YEARS
Height.....	.04	−.05
Weight.....	−.01	−.08
Physical capacity.....	.08	−.01

SUMMARY OF CONCLUSIONS

1. Physical strength, or capacity, as measured by the Roger's test, increases rapidly throughout the adolescent years, virtually doubling from age twelve to age sixteen.

2. The most rapid development of strength takes place during the year which follows the attainment of post-

pubescence. This suggests that the most rapid development in strength follows the period of most rapid growth in height and weight.

3. Motor ability, or coördination, as measured by the Brace test, increases throughout the adolescent years, but less rapidly in the period during which pubescence is reached (P_{1-2}) than during a similar period in the pre-pubescent status or following puberty.

4. The period of most rapid growth in height and weight is accompanied by substantial improvement in motor coördination.

5. The evidence yielded by an analysis of actual cases does not support the notion that where growth in height and weight is especially rapid loss of motor control, with subsequent awkwardness, is likely to take place.

We conclude, then, that awkwardness in adolescents is more likely to accompany the rather *sudden beginnings of growth* in the P_{1-2} period than the later and more rapid growth.

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The Influence of Verbal Directions on Behavior

MARGUERITE WILKER JOHNSON

THAT behavior and personality are modified by the speech of others and that special care should therefore be used in addressing verbal directions to children, has been recognized by many adults for centuries, largely on an intuitive basis. More recently their belief has been verified in part by experiments reported throughout the literature on the effect of verbal suggestion on both normal and abnormal subjects. But inconsistent variations in the advice now being given teachers concerning their own attitudes and conduct in relation to the children with whom they work indicate that conflictingly different interpretations are being made of both the intuitive belief which is stated in terms of principles and the experimental data which have reinforced some of the theory.

In either casual or directed observation of everyday practice, one encounters incidents like this one:

> "We shall now have our rest," said an adult to ten four-year-olds, "and we shall go on tiptoe for our rugs."
>
> Two of the ten children went on tiptoe and eight walked.

Such observation suggests a variety of questions for further study. Should nursery school teachers ask four-year-olds to tiptoe? At what age and under what conditions is there a dynamic relationship between directions to tiptoe and the learning to tiptoe? And what is the nature and history of such a relationship?

> Ten minutes later on the same day, the adult said, "Dick, you aren't having a very good rest today;" in a moment, "Bob, you lie down;" and still later, "Mary, stop wiggling."

No doubt all would agree that it is difficult to say, in the light of present-day knowledge, what effect such verbal influences are having on the behavior of children and on what basis of understanding, or lack of it, they are being used by adults.

In view of the fact that mere extent of vocabulary is one of the most reliable indexes of intelligence, as has been shown by Terman and others, a survey of one's verbal directions to others should yield considerable information as to his own intelligence, education, beliefs, and attitudes. Moreover, a systematic experimental survey of behavior in response to different verbal directions should yield additional information. It is even likely that some sort of an index to personality might emerge through experimental study of the words one speaks as directions and of the words one reacts to. This type of index, since language, spoken or reacted to, implies at least two people, would

undoubtedly yield some knowledge as to existing relationships between persons. More exact understanding, then, of the functions of different types of verbal expressions might serve both as a means for formulating helpful general principles concerning behavior and as a basis for devising further techniques for studying individual differences and personality.

With the expectation that verifiable evidence as to the relative effectiveness of different verbal suggestions used with children at all ages in various situations might answer some of the questions in child development and also indicate further profitable and systematic approaches to the study of child-adult relationships, the writer initiated a series of studies. Results have been obtained in 70 different experimental situations on the influence of verbal directions with children from three to seven years of age. A preliminary study and the general tendencies revealed in the first 6 situations of the larger study are reported in this paper. Lady O'Brien carried on the work of investigation under the direction of the writer.

A simple experiment was carried on in 1931 as an exploratory beginning in the attempt to find out how much difference would occur in a natural everyday type of situation in the behavior of 37 pairs of children when one child was given one type of verbal direction and his mate (in age, sex, and intelligence) was given a different type of verbal direction.

Seventy-four children ranging in age from two-and-a-half to seven-and-a-half years, enrolled in the University Elementary School at the University of Michigan, were invited by an experienced worker to go to a room, one at a time, to look at some new books. The room was furnished with a desk and chair for the worker, and a child's table and chair in one corner. Five new picture books were arranged in a pile on the floor, scattered in such a manner that the child in seating himself at his table would need to step over them. On entering the room with the child, the worker said to each member of the control group, "Someone left the books on the floor. You may look at them." To each mate in the experimental group, she said, "Someone left the books on the floor. Pick them up. You may look at them." The same attitude was assumed, as nearly as possible, with each child, and the words were spoken quietly. The worker took care not to express surprise or disapproval, but merely to state that someone had left the books on the floor. It is conceivable, of course, and highly probable that slight variations in expression occurred; but the work proceeded on the assumptions that complete control in the most precisely measured situations is as yet impossible, and that a systematic, though rough, study of phenomena so universal, constantly practised, and little understood as the influence of verbal direction might yield some true and pointed information about behavior.

Specifically, the questions in mind were, Will children aged two-and-a-half to seven-and-a-half years who are accustomed to finding books on tables or shelves, not on floors, and who receive daily training at home and school in placing books where they

belong, pick up the books without being told, "Pick them up"? Or, will they not feel free to do so or be interested in doing so, even though the books serve as an obstruction preventing easy accessibility to the chair? How much will the inclusion, for one group, of the words "Pick them up," and their omission for the other group affect the behavior of the children?

group. The age results in the experimental group with regard to placing the books on the table were: 13.5 per cent of the three-year-olds, 24.3 per cent of the four-year-olds, 24.3 per cent of the five-year-olds, and 27 per cent of the six-year-olds. The corresponding results for the control group were respectively 5.4 per cent, 0, 5.4 per cent and 8.4 per cent. The

TABLE 1

Relative effectiveness of two types of verbal directions in influencing children to pick up books from the floor

AGE IN YEARS	CHILDREN		PICKED UP BOOKS	
	Group	Number	Number	Per Cent
Three	Experimental	7	5	13.5
	Control	7	2	5.4
Four	Experimental	9	9	24.3
	Control	9	0	0
Five	Experimental	10	9	24.3
	Control	10	2	5.4
Six	Experimental	11	10	27.0
	Control	11	3	8.1
Total	Experimental	37	33	89.2
	Control	37	7	18.9
Difference in favor of experimental group			26	70.2
Probable error of the difference*				5.4
Difference divided by the probable error				13.0

* The formula $P.E._p = .6745\sqrt{\frac{pq}{n}}$ was used in this study for the probable error of the proportion of successes.

All 74 children, the results indicate, spent some time looking at the books. In the experimental group 33, or 89.2 $\pm$ 3.4 per cent (Table 1) of the 37 children placed the books on the table. In the control group 7, or 18.9 $\pm$ 4.3 per cent, of the 37 children did so. The difference of 70.3 $\pm$ 5.4 per cent most significantly favors the directions given the children in the experimental

behavior of the children, then, at all ages was unquestionably influenced by the inclusion and omission of the words, "Pick them up." This preliminary study was followed by an investigation, extending over three years, of the behavior of the same children in different situations involving different types of verbal direction. A complete report of the entire investi-

gation to date on the relative effectiveness of different verbal directions with children, combined with a review of the experimental literature on the same subject, is being prepared for publication.

The procedures in the larger investigation were merely to ask the 38 children in the experimental group, one at a time, to perform simple tasks, to solve problems, and to inhibit certain tendencies by using one kind of verbal expression; and to ask their control mates to perform, in the same controlled situation, the same tasks, problems and inhibitions by using a different type of verbal expression. An attempt was made to place the child in attractive situations and ask him, with everyday kinds of requests to do simple things, interesting and natural to him. No attempt was made to use exact opposites in verbal directions since "opposites" are not known and may not even exist. The first 6 experimental situations are described in this report, with the materials and verbal directions that were used and the results that were obtained.

The 6 different situations or experiences occurred in the same order, one after the other, during one visit to a room that was set up in the same way for each child. The goals for the child, so far as the adult was concerned, were as follows:

1. To cut a circle from paper economically.
2. To refrain from opening a red box.
3. To persist in opening a Chinese puzzle box.
4. To dress a doll.
5. To untie a simple sailor's knot.
6. To complete a jigsaw puzzle promptly.

The children appeared to enjoy themselves and to take part willingly in all of the experiments. The immediate general goal for each child was to make a visit to a room to play games and the specific goals varied with the types of verbal directions given by the adult in the separate situations. Each situation was treated as here described, with only one request, which was made in the words reported. The children's visits to the room averaged about ten minutes. It seemed wise in this initial work to be governed by the natural course of events. Accordingly, the adult proceeded naturally with the child, without artificial time limits, guiding him unobtrusively from one experience to another.

RESULTS IN SIX EXPERIMENTAL SITUATIONS

1. *The Paper Circle*

A plain sheet of manilla paper 8½ x 11 inches in size, a pair of Bradley scissors, and a paper circle 3 inches in diameter were the only materials that lay on the child's table. On entering the room, the worker approached the table and said, as she held the paper circle before the child, "Cut a circle for yourself." Her subsequent directions were differentiated as follows:

E. To each child in the experimental group she said, "Cut it in the corner to save the paper."

C. To each child in the control group she said, "Don't waste the paper."

The criterion of success was to cut

the circle in any one quarter of the 8½ x 11 sheet of paper.

Results. The "Do" type of direction was very much more effective than the "Don't" type of direction in this problem situation with children learning to use paper economically. In the experimental group 26 of the 38 children, or 68.4 ± 5.09 per cent (Table 2), succeeded in cutting the paper circle from one of the four quadrants of the sheet of paper. In the control group 16, or 42.1 ± 5.40 per cent of the 38 children did so. The difference of 26.3 ± 7.43 per cent is significantly in favor of the experimental group. This difference would, no doubt, be still more striking if the children had not been previously equalized somewhat, by the usual home and school training in the saving of paper. This finding appears to support the psychological admonition, "Tell children what to do instead of what not to do," and is also in agreement with a number of earlier results obtained in experimental situations with older children and adults.

TABLE 2

Relative influence of positive-encouraging (Experimental) and negative-discouraging (Control) verbal directions in six experiments with 38 children. The same 38 experimental children and 38 control mates were involved in each situation

SITUATION	PERFORMANCE	NUMBER OF CHILDREN SUCCEEDING		PER CENT OF ALL CHILDREN SUCCEEDING	DIFFERENCE IN FAVOR OF EXPERIMENTAL GROUP	D ÷ P.E.$_d$
1. Paper circle	Cut circle from one quadrant	Experimental	26	68.4 ±5.09	26.3 ±7.43	3.54
		Control	16	42.1 ±5.40		
2. Four boxes	Refrained from opening "red" box	Experimental	34	89.5 ±3.35	5.3 ±5.21	1.02
		Control	32	84.2 ±3.99		
3. Puzzle box	Persisted longer than mate in attempt to open box	Experimental	36	94.7 ±2.45	89.4 ±3.46	25.80
		Control	2	5.3 ±2.45		
4. Doll	Dressed doll entirely or in part	Experimental	36	94.7 ±2.45	60.5 ±5.74	10.56
		Control	13	34.2 ±5.19		
5. Sailor's knot	Untied sailor's knot	Experimental	35	92.1 ±2.95	42.1 ±6.22	6.77
		Control	19	50.0 ±5.47		
6. Picture puzzle	Completed puzzle sooner than mate	Experimental	23	60.5 ±5.35	21.1 ±7.55	2.79
		Control	15	39.4 ±5.34		

2. *The Four Boxes*

Four white pasteboard boxes, with covers, were placed on the table in front of the child. They were distinguished by colored paper circles on the covers, and contained the following materials:

1. Box with blue circle, a small toy auto.

2. Box with green circle, a wooden doll.

3. Box with yellow circle, a china doll.

4. Box with red circle, a pencil and some paper clips.

To each child the worker said, "There are toys in the boxes. You may look at them."

E. To the children in the experimental group she continued, "Leave the red box closed."

C. To the children in the control group she continued, "Don't open the red box."

The worker pointed to the red box as she spoke the words "red box."

Results. It appears that the "Do" type of direction tends also to be more effective than the "Don't" type in obtaining an inhibition in the behavior of children. In the experimental group 34 of the 38 children, or 89.5 ± 3.35 per cent (Table 2), refrained from opening the red box. In the control group 32, or 84.2 ± 3.99 per cent of the 38 children did so. The difference of 5.3 ± 5.21 per cent, while not statistically conclusive, is substantially in favor of the experimental group. Certain questions arise here which have already been the subject of experimental study, with inconclusive results in laboratory situations with older subjects. Does a "Don't" type of direction approach "positiveness" when prohibition is the goal? If so, by what process? If not, how may it be of assistance or hindrance with reference to or in connection with a positive "Do" type of verbal direction?

3. *The Puzzle Box*

An oblong Chinese puzzle box 1½ x 4 x 6½ inches, permanently locked by a secret panel, was presented the child. To each child the worker said, "Open this box." When the child had persisted for 30 seconds by the stop watch, further directions were differentiated as follows:

E. To the children in the experimental group she said, "You can do it."

C. To the children in the control group she said, "Is it too hard for you?"

A record was made of the time the child persisted in his attempt to open the box. When he indicated with some note of finality, such as saying, "I can't do it," or "You do it," or by putting the box down or leaving it, the trial was considered ended.

Results. The findings are clearly in favor of encouraging rather than discouraging verbal expression. In the experimental group 36, or 94.7 ± 2.45 per cent (Table 2), of the 38 children persisted in their attempt to open a box longer than their mates in the control group. In the control group 2, or 5.3 ± 2.45 per cent, of the 38 children persisted longer than their mates in the experimental group. The difference of 89.4 ± 3.46 is overwhelmingly in favor of the experimental group. It should be said in passing, however, that discouragement as a mode of influence, cannot be summarily dismissed until the significance of 2 discouraged children's exceeding 2 encouraged children is understood. In general, encouragement as a device of

influence should be advocated, but in particular, discouragement should be investigated with reference to individual characteristics.

4. *The Doll*

An Effan Bee doll of medium size lay on the table with three articles of doll clothing, consisting of bloomers on a rubber band, an underslip, and a dress.

E. To the children in the experimental group the worker said, "It is time to dress the doll now."

C. To the children in the control group she said, "Do you want to dress the doll?"

Results. In the experimental group 36, or 94.8 ± 2.45 per cent (Table 2), of the 38 children dressed the doll, entirely or partially, when told to do so. In the control group 13, or 34.2 ±5.19 per cent, of the 38 children dressed the doll. The difference of 60.6 ± 5.74 per cent in favor of the experimental group may be considered statistically conclusive.

5. *The Sailor's Knot*

A short piece of clothesline rope about 3 feet long, in which there was tied a single sailor's knot, was handed to the child as the worker said, "Here is a rope."

E. To the children in the experimental group she said, "Untie this knot. Slip through here first," as she pointed to one end.

C. To the children in the control group she said, "Untie this knot."

Results. The more specific direction used with the children in the experimental group was significantly more advantageous to them in untying a sailor's knot than the direction given to the control group. In the experimental group 35, or 92.1 ± 2.95 per cent (Table 2), of the 38 children untied the knot. In the control group 19, or 50 ± 5.47 per cent, of the 38 children succeeded in untying the knot. The difference of 42.1 ± 6.77 per cent is very significantly in favor of the experimental group.

TABLE 3

The number of children succeeding at each age in response to positive-encouraging (Experimental) and to negative-discouraging (Control) verbal directions in six experimental situations

AGE IN YEARS	NUMBER CHILDREN IN EACH GROUP		NUMBER OF CHILDREN SUCCEEDING IN EACH SITUATION												TOTAL CHILDREN SUCCEEDING			
			Paper Circle		Four Boxes		Puzzle Box		Doll		Sailor's Knot		Puzzle Picture		Number		Per Cent	
	E*	C	E	C	E	C	E	C	E	C	E	C	E	C	E	C	E	C
3	6	6	2	0	4	5	6	0	6	3	3	2	3	3	24	13	66.6	36.1
4	8	8	4	4	7	5	8	0	7	1	8	0	5	3	39	13	81.2	27.0
5	7	7	5	4	7	6	7	0	7	2	7	4	5	2	38	18	90.4	42.8
6	10	10	9	3	10	9	10	0	9	6	10	7	4	6	52	31	86.6	51.6
7	7	7	6	5	6	7	5	2	7	1	7	6	6	1	37	22	88.1	52.3
Total...	38	38	26	16	34	32	36	2	36	13	35	19	23	15	190	97	83.3	42.5

* E = Experimental, C = Control.

6. *The Picture Puzzle*

"Our time is up but here is a picture puzzle," said the worker to the child.

A record was made of the time taken by the child to complete the puzzle. Four pieces for completion were used with the seven- and six-year-olds; 3 pieces for the five-year-olds and 2 pieces for the four- and three-year-olds.

Results. In this jigsaw puzzle task the advantage of a calm request informing the child of the need to work "promptly" is clear. In the experi-

TABLE 4

Relative influence for each sex of positive-encouraging (Experimental) and negative-discouraging (Control) verbal directions in six experiments. The same 21 boys and 17 girls in the experimental group and 21 boys and 17 girls in the control group were involved in each situation*

SITUATION	GROUP	NUMBER CHILDREN SUCCEEDING	PER CENT OF ALL CHILDREN SUCCEEDING	DIFFERENCE	D ÷ P.E.$_d$
1. Circle paper.....	Experimental	Boys 14	66.7 ±6.93	3.9 ±10.19	0.38
		Girls 12	70.6 ±7.47		
	Control	Boys 7	33.3 ±6.93	19.6 ±10.71	1.83
		Girls 9	52.9 ±8.17		
2. Four boxes.....	Experimental	Boys 19	90.5 ±4.32	2.3 ± 6.81	0.34
		Girls 15	88.2 ±5.27		
	Control	Boys 18	85.7 ±5.13	3.3 ± 8.07	0.41
		Girls 14	82.4 ±6.23		
3. Puzzle box.....	Experimental	Boys 20	95.2 ±3.15	1.0 ± 4.95	0.2
		Girls 16	94.2 ±3.82		
	Control	Boys 1	4.8 ±3.15	1.0 ± 4.95	0.2
		Girls 1	5.8 ±3.82		
4. Doll.....	Experimental	Boys 19	90.5 ±4.32	9.5 ± 4.32	2.2
		Girls 17	100.0 ±0		
	Control	Boys 2	90.5 ±4.32	25.8 ± 8.93	2.89
		Girls 11	64.7 ±7.82		
5. Sailor's knot.....	Experimental	Boys 20	95.2 ±3.15	7.0 ± 6.14	1.14
		Girls 15	88.2 ±5.27		
	Control	Boys 9	42.8 ±7.30	16.0 ±10.87	1.47
		Girls 10	58.5 ±8.05		
6. Picture puzzle....	Experimental	Boys 16	76.2 ±6.27	35.0 ±10.20	3.4
		Girls 7	41.2 ±8.05		
	Control	Boys 5	23.8 ±6.27	35.0 ±10.20	3.4
		Girls 10	58.8 ±8.05		

E. To the children in the experimental group she continued, "You can do it promptly."

C. To the children in the control group she said, "Hurry up and do it. Hurry up."

mental group 23, or 60.5 ± 5.35 per cent (Table 2), of the 38 children completed the puzzle sooner than their control mates. In the control group 15, or 39.4 ± 5.34 per cent, of the "hurried" control children completed the task sooner than their mates. The difference of 21.1 ± 7.55 per cent in favor of the experimental group is practically conclusive.

An analysis of the results in the six different situations according to age and sex shows that the children in the experimental group were superior to their mates in the control group in doing as they were requested (Tables 3 and 4) for both boys and girls at all ages in all situations.

An analysis of the sex differences that occurred in three of the 12 different groups (Table 4) reveals the fact that boys in the control group failed to give the desired response in the *doll* situation (3) more often than girls in the same group when asked, "Do you want to dress the doll"? A few excerpts from the record of all spontaneous remarks made by the children in the various situations verbalizes some of the prejudices held by the boys against dolls.

M. T. "Well, I won't do it." "Yes, I guess I will." "Is this the way?" "I bet P. (a girl) knows how." "This is the first time I ever dressed a doll, and the last time, too." "I feel like a sissy." "I just don't like to dress dolls."

S. P. "Why, I don't play with dolls."

K. T. "That's a girl's job."

A sex difference seems to be indicated in the *picture puzzle* situation (6) where boys exceeded girls when directed, "You can do it promptly," and girls exceeded boys when told to "Hurry up." Considerable additional exploration of the effect of verbal directions involving time limits with young children is needed for clarification of the dynamic relationship that may exist.

A summary, then, of the more and the less effective verbal directions in this study can be listed as follows:

More Effective

1. "Cut it in the corner to save the paper."
2. "Leave the red box closed."
3. "You can do it."
4. "It is time to dress the doll now."
5. "Untie this knot. Slip through here first."
6. "You can do it promptly."

Less Effective

1. "Don't waste the paper."
2. "Don't open the red box."
3. "Is it too hard for you?"
4. "Do you want to dress the doll?"
5. "Untie this knot."
6. "Hurry up and do it. Hurry up."

In general, the greater number and per cent of successes achieved in each situation by the children in the experimental group, who were given the more positive, unhurried, specific and encouraging types of directions, as compared with the successes of the control children, who were given the more negative, general, hurried and discouraging verbal directions, indicates the superiority of the former over the latter types of directions. Some of these same situations have been repeated in subsequent experimental research, and additional results have also been obtained in similar, as well as in different situations in order that a study of individual differences and further interpretations might be based on more data.

Sex Differences in Skeletal Development

CHARLES D. FLORY[1]

EVERY one is aware of the many structural differences between the sexes. However, the extent to which boys and girls differ in their developmental rate needs further elaboration. Females are ahead of males in the speed with which they move toward physiological maturity, in the eruption of deciduous teeth, in the acquisition of locomotor ability, in the appearance of permanent teeth, in the onset of procreative ability, and in the completion of physical growth. Girls at any age and for any physical trait have attained a larger percentage of their maximum development than have boys of the same age. There is a growth potential related to sex which determines to some extent the rate at which growth and development take place.

It is the purpose of this paper to consider sex differences in the rate of skeletal growth and the degree of difference in skeletal development as revealed by roentgenograms of the hand. Some investigators apparently do not take into account the differential growth rate associated with sex, for they write as though differences in skeletal development were nonexistent or at least insignificant. Other authors have disregarded these differences except at the pre-adolescent period which has led to the postulation of significant pre-pubertal spurts in skeletal growth. Evidence will be presented in this study which seem to support Pryor's (6) contention that "The bones of the female ossify in advance of the male. This is measured at first by days, then months, then years." Pryor (7 and 8) has been accumulating facts during the past three decades which consistently indicate an increasing sex difference from birth to early adolescence.

The subjects.—Data for this investigation consist of more than 6,500 roentgenograms of the right hand of subjects from birth to maturity. One hundred newborn infants, 300 children from age one to four inclusive, 6,000 school children from the University of Chicago Laboratory Schools, and over 200 college students served as subjects in this investigation. These roentgenograms have been analyzed both by measurement and by inspectional techniques. The facts obtained will be presented to show the magnitude of sex differences in osseous processes from age to age.

Differences at birth.—Although the appearance and development of carpal bones are chiefly post-natal phenom-

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ena, children are occasionally born with one or more carpal centers. Adair and Scammon (1) show that ossification proceeds slightly faster in females in intrauterine life. Menees and Holly (5) found ossification among 4 per cent of the newborn males and among 12 per cent of the newborn females. Hess and Weinstock (4) found females ahead of males both among white and Negro children. The writer found ossification centers at birth in 2 per cent of the males' hands and in 8 per cent of females' hands. A typical hand at birth and the hand of a newborn girl which has two carpal centers are presented in figure 1. A consideration of sex difference on the basis of bone appearance alone shows that a given carpal center usually appears in the hands of girls before it does in the hands of boys, with an increase in the sex difference as the age of appearance increases. That is, the sex difference in the time of appearance of the capitatum is less than the difference in the average age for the appearance of the pisiforme. The radial epiphysis and the lunatum appear about six months earlier in girls' hands than in boys' hands, while the ulnar epiphysis appears one whole year earlier in the hands of girls. Pisiforme appearance suggests nearly two years of sex difference. These facts on the basis of bone appearance indicate an increasing sex difference in skeletal development at least until the beginning of adolescence.

FIG. 1. OSSIFICATION IN A TYPICAL NEWBORN HAND AND IN THE HAND OF A NEWBORN FEMALE WITH TWO CARPAL CENTERS

Qualitative differences.—An evaluation of skeletal development on the basis of the quality of the ossification reveals significant sex differences. Figure 2 presents direct tracings from roentgenograms for a five-year-old girl and a six-year-old boy. These two

roentgenograms have been taken from a series of standards selected by the writer (2). They have been selected as typical of the development of each sex at the ages indicated. Inspection reveals that the five-year-old girl is skeletally as fourteen-year-old boys. This two-year difference is maintained at ages thirteen, fourteen, and fifteen. Fifty per cent of the girls have reached skeletal maturity at age seventeen when epiphyseal closure in the hand is

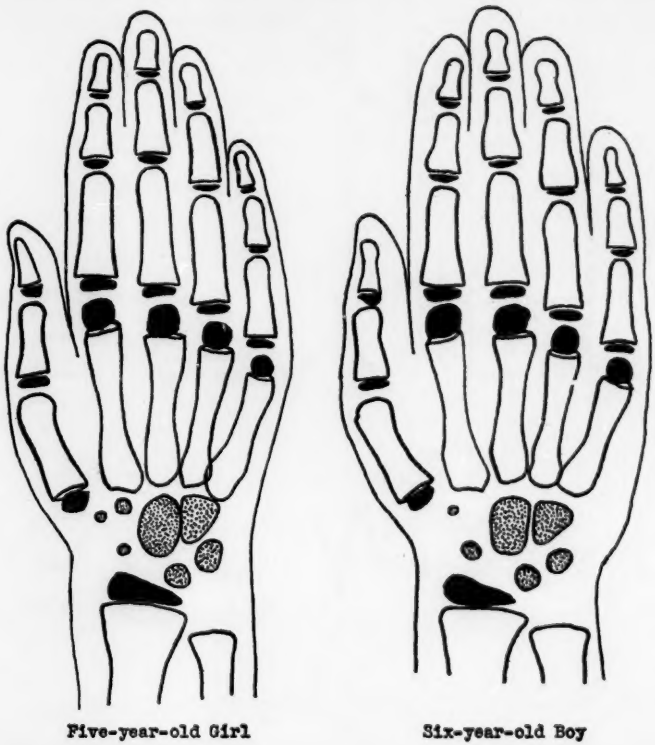

FIG. 2. OSSIFICATION IN TYPICAL HANDS FOR FIVE-YEAR-OLD GIRLS AND SIX-YEAR-OLD BOYS

fully as far along in her development as the six-year-old boy. It is significant indeed that there is a difference of one full year between the sexes in skeletal development at the average age for school entrance. By age twelve girls are as fully developed used as the criterion of skeletal maturity. Fifty per cent of the boys reach maturity, when judged by the same standard, at eighteen and a half, or one and a half years later than girls. Few studies dealing with sex differences in achievement or social adjust-

ment have taken account of these physiological facts. The oversight has been in part due to the excessive emphasis on the differences between the sexes at adolescence with a neglect of the cumulating physiological superiority of females which has been in progress from conception.

at some point. Growth curves for these three bones for girls and boys respectively are presented in figures 3 and 4. Inspection of these curves shows at once that the crossing point is at eight and a half for girls and at ten for boys. This fact suggests approximately one and a half years of

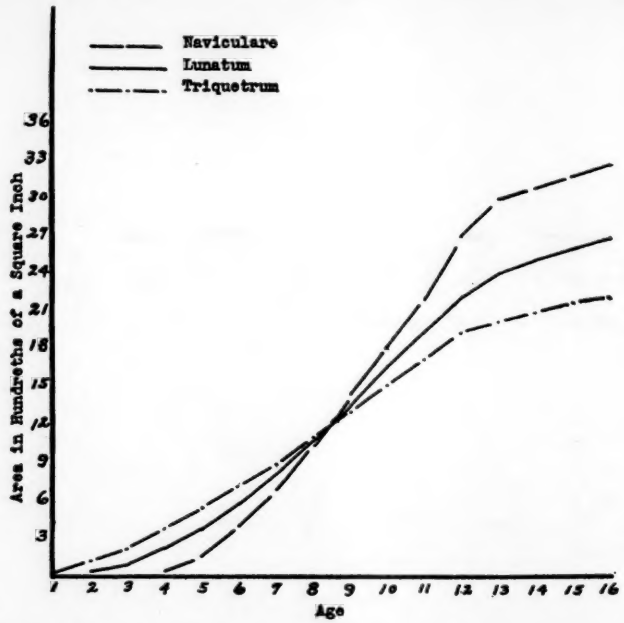

FIG. 3. GROWTH CURVES FOR THE NAVICULARE, LUNATUM, AND TRIQUETRUM FOR GIRLS

Differences in bone growth.—The size of the bone shadows in the roentgenograms of the hand have been determined from age to age by planimeter measurements. Inspection and measurement both show that the naviculare, lunatum, and triquetrum appear in the reverse order of their ultimate size. This fact means that growth curves for these three bones will cross

sex difference in skeletal development in the middle years of the elementary school or at about age nine.

Growth curves for the total area of all carpal bones suggest that girls are near their maximum at age fifteen while boys approach their maximum carpal development to about the same degree at age seventeen. Growth of bones in size indicates approximately

one and a half years of sex difference at age nine and two years difference at age sixteen. Girls are significantly ahead of boys in skeletal development when they enter the elementary school but they are still farther ahead when they enter high school, as long as chronological age is the major concept in school admissions and school progress.

Ossification ratios.—An evaluation of skeletal development by means of an ossification ratio (3) shows that there are significant sex differences. Growth curves for the total ossified area in the wrist and the area of the carpal quadrilateral are presented in figure 5. The ossification ratio equals one (1.00) at the point where these two curves cross. It can be seen from figure 5 that girls have an ossification ratio of 1.00 just prior to age 12 while boys have the same degree of development shortly before age 14. The ossification ratio therefore indicates two years of sex differences in skeletal development as children enter upon adolescence. Since the beginning of adolescence corresponds roughly with the age for high-school entrance, it appears that girls and boys differ approximately two years skeletally when they enter the secondary school due to differences in the rate of growth of the sexes.

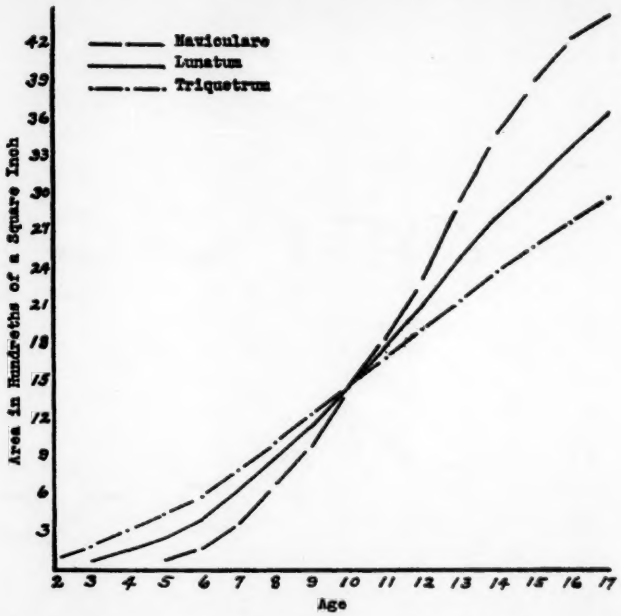

FIG. 4. GROWTH CURVES FOR THE NAVICULARE, LUNATUM, AND TRIQUETRUM FOR BOYS

Variability in skeletal development.—

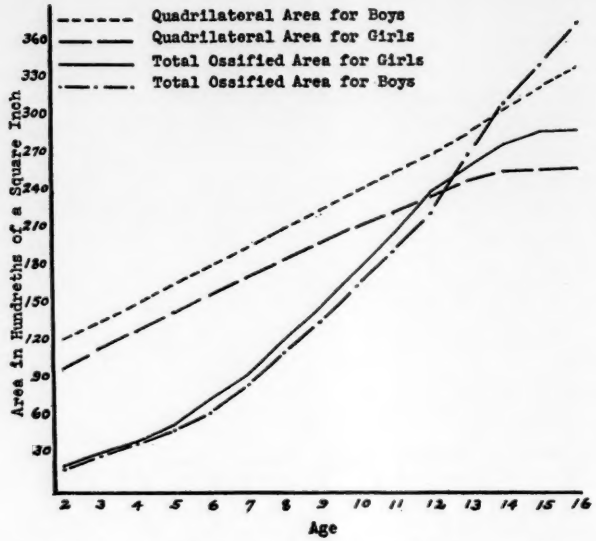

FIG. 5 GROWTH CURVES FOR THE TOTAL OSSIFIED AREA IN THE WRIST AND THE AREA OF THE CARPAL QUADRILATERAL FOR BOTH BOYS AND GIRLS

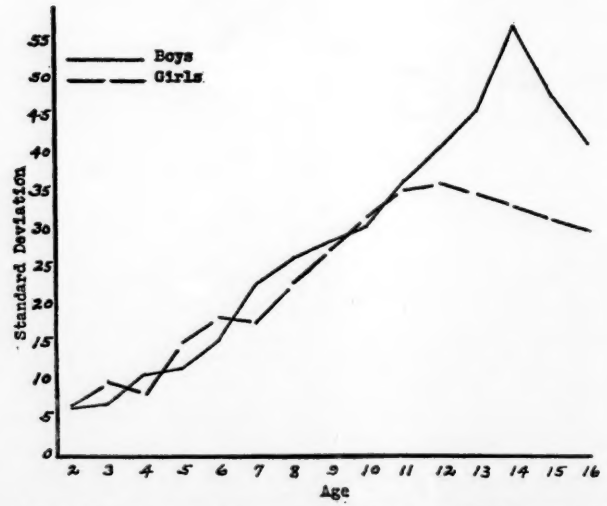

FIG. 6. THE VARIABILITY OF OSSIFICATION RATIOS FOR BOTH BOYS AND GIRLS

Evidence thus far presented seems sufficiently consistent to substantiate the contention that sex differences in osseous processes increase from year to year until the beginning of adolescence. Further evidence can be produced from an analysis of the variability in skeletal development. The variability from age to age for the ossification ratio is shown in figure 6. The ages at which these two curves for boys and girls reach their peak are significant. Girls are most variable in skeletal development, when evaluated by the ossification ratio, at age twelve. Boys are the most variable at age fourteen, two years later than girls. This point adds support to the contention that boys and girls entering high school differ about two years in skeletal development due to a more rapid physiological development among girls.

Standard deviations for skeletal months ratings, on a qualitative scale of development, show a similar degree of difference. Girls reach their peak in variability at age thirteen and boys at age fifteen. Here again a difference of two years is indicated. Another fact from qualitative ratings is quite significant. When ossification evaluations make use of epiphyseal closure as the final criterion of skeletal maturity, it is clear that zero or practically zero variability will be reached at maturity. University of Chicago Laboratory School girls reach zero variability on the qualitative scale at age nineteen. Boys do not reach zero variability until sometime beyond age twenty. Boys at age twenty have attained about the same stage of development as girls have reached at age eighteen. These facts indicate a two year sex difference through the secondary school and suggest that girls reach maturity about two years ahead of boys.

Conclusions.—The foregoing facts show to some extent the magnitude of sex differences in skeletal development from birth to maturity. Intrauterine growth rates are definitely related to sex. Girls are ahead of boys at birth; they are about one year ahead at school age; they are approximately one and a half years ahead at age nine; and about two years ahead of boys at the average age for the onset of puberty. Evidence has been presented which suggests that the differences in skeletal development due to sex are constantly increasing from birth to ages twelve or thirteen. Girls in high school are skeletally about two years ahead of boys. High-school administrators are dealing with a group of girls who are anatomically significantly more mature than boys. Girls reach skeletal maturity from a year and a half to two years earlier than boys. The increasing difference in skeletal development and the earlier maturation on the part of girls must be taken into consideration if a given school population is to be administered effectively and efficiently. Studies of sex differences in other aspects of development which disregard the maturity factor may have to be reinterpreted. It is true that some children have pre-adolescent spurts in growth but it seems to be of more importance to recognize fully the gradually increasing difference in osseous processes than to identify slight pre-pubertal accelerations in growth rates.

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Mental Deficiency in Relation to Inter-Marriage

MARIAN M. RAU

THE object of this study was to discover to what extent there was feeble mindedness among the children in the country schools of chosen districts of a county in Devon, England where there was reported to have been a great deal of inter-marriage due to isolation. The children were tested by Burt's Revision of Binet's Intelligence Tests and by a group of performance tests in order to have two tests of their intelligence. For a basis of comparison the children in an institution for the mentally defective were tested in the same manner. Their familiarity with the questions in the intelligence tests and training in certain types of performance were taken into consideration. The children in this institution were tested every year by the Stanford Revision of Binet, which is very similar to that of Burt's, and which gave them some advantage over the country children, none of whom had ever been tested before. Also these institution children have been receiving special training in drawing and handwork, and there is a possibility that this might raise their scores in the performance tests. After having considered the effect of these factors, the results were compared with those obtained from the country school in order to discover whether the country schools contained many children of the same low degree of intelligence that the government considered worthy of special institutional care under the Education Acts.

Burt's revision of Binet's tests follows the original closely as far as the material is concerned, the only difference being in the assortment and age assignments. This was necessary as the Binet-age Assignments which had been based on tests given to French children were not wholly applicable to English children. For instance, many older normal children in London, when given the tests appeared to be defective, and many defective younger children had higher results than they merited. The changes in the material itself in the tests are very slight, and when there was any modification, both forms are given and the cause for the change. Burt himself says that the alterations are only made in order to "carry out more completely the spirit of the original." He admits frankly that the version is not faultless, and that an entirely new series of scales must be constructed, but as this would demand a long time in research, he aims solely to give a version that adheres more closely to the original French authors than any other of the published forms.

Burt's tests were given in the man-

ner he suggests for the defective; that is, rather than starting at the tests appropriate for the child's actual age, as this would naturally mean working from the harder to the easier, the sequence was more or less governed by the following rules of Burt:

(1) The picture tests, coin tests, or name and age were given first in order to let the child get over his first feeling of nervousness.

(2) After this, when the child had become used to the examiner, the memory tests were given, then following up with the test requiring more effort, such as the oral problem tests. Care has to be taken of course that these tests are given when the child is at his highest point, pleased with having succeeded in the earlier tests, and yet not tired or bored.

The record of each child was kept separately, although the amount recorded was definitely limited by the fact that there was only one examiner, and, in order not to bore the child by long waits, only the necessary record was kept.

The performance tests were given in some cases as long as two weeks after the child had taken the Burt test, although in the smaller schools the interval averaged about two days. Certain tests for which scores for groups of children were available were chosen and combined into a performance test that seemed to include the necessary aspects of performance. Norms for these tests were obtained by averaging the scores made by children of normal intelligence in good country schools. The tests used were as follows: The Porteus Maze; The Knox Cubes; Manikin Test; Kohs Block Design test; Healy Puzzle; and Goodenough Drawing of a Man.

Scores of performance tests in schools used as normal schools

SCORE	NUMBER OF CHILDREN	APPROXIMATE C. A. OF CHILDREN
		years
10–14	5	5
15–19	12	6
20–24	15	7
25–29	23	8
30–34	17	9
35–39	21	10
40–44	13	11
45–49	3	12
50–54	6	13–14
55–59	7	15–16

Scores below 8 years not reliable.

These performance tests are important not only for judging the approximate mental age from the scores obtained, but to observe the methods of each child individually and to see why he failed or succeeded. Granting that the scores are in a manner a rather fair mark for if the method is good, the score is high, and vice-versa, but at the same time in certain individual cases success can be obtained by a poor method after a time. There is a rather good example of this with the manikin, where a child could obtain all four points, the complete score, even if he had made attempts to fit the arms in for the legs or any other more unintelligent response as long as he did not exceed the time limit. In generalizations for statistics of course all these methods cannot be considered, but if the child's case is to be studied individually, his manner of attack should be recorded for reference.

Village Number A, the first one visited, remains unique among the other villages in having by far the greatest number of inter-marriages among its inhabitants. As this is of greatest importance when the children's intelligence is being considered, in each case all the material that could be discovered was recorded. Considering the isolation of all the places that were visited, it is easily understood how a great deal of inter-marriage does take place, for there is no way for the inhabitants to mix with other people. For many years three or four large families have made up the sole population of the village. In quite a number of cases, when there have been highly intelligent individuals, they have not been satisfied with farm work, and have ventured out into a more populated district, leaving the duller ones behind to produce the next generation. In this specific case, the village was made up almost entirely of one very large family, which, according to legend, was started by a member of the Spanish Armada left stranded on the shores. The average Intelligence Quotient of the children of this family that were in the school was found to be 75. There was another large family, which, although not so large and old as the other, furnished quite a number of the small population. The average Intelligence Quotient of these children was about 90, only 2 being below the ninety mark, which shows that their mentality is definitely much higher than that of the first family mentioned. The weakness of this family lies mainly in their physical handicap. They are all undernourished and all except one have extremely bad eyesight. They are very small and thin, and appear to be susceptible to diseases that come into the school. In the first family 4 out of 5 of the children had parents that were first cousins, and the fifth had grandparents that were related, while in the second family 2 children out of 8 had parents that were first cousins, and no inter-marriage could be found among the other members. Of the rest of the children in the school, 3 of them were directly related to the first family, 2 of them had parents that were first cousins and 1 child had a mother in a home for mentally deficient patients. This last child was being watched carefully, and treated with rather extreme kindness, as she was definitely peculiar, and her relatives were afraid of her mental instability. All the children that have not come under one of the former classes came from scattered families about the village, and, although no definite inter-marriage was found, their parents were in most cases of the dull sort that one finds left in these isolated districts. Most of the children's fathers were farm laborers, receiving the set rate of 32/6d ($7.10) a week, although a few were mill workers, wood choppers and rabbit trappers. As the size of the families ran from four to ten, the struggle to get along was rather extreme in some cases. There were busses several times a day to the nearest town, and although the inhabitants would have to walk only a mile each way in order to catch a bus, the headmistress said that very few ever went, and those few went only to the cinema, and did not mix with the town people. While talking to a village

wood chopper, working on the squire's land, it was found that he had never left that part of the country because he was afraid of wild animals! This is just an example to show the extreme ignorance of these isolated people about the outside world. That man earnestly believed that there were wild animals in all other parts of the country that would hurt him. He willingly admitted that he could not "get on" here, as there were no opportunities, but he was afraid to leave.

The children in the schoo' had never seen a railway station un' they were taken by the present headmistress about two and a half years before. At present they very seldom went away, and some had never left the village. If they are taught anything about history or current events, all the subjects have to be in some way related to their present lives, or it makes no impression, for it is so very far removed. The whole atmosphere of the village was friendly, although a bit gossipy, and the people mixed among themselves quite well.

As far as the school was concerned, the work being done was rather doubtful, for, although the headmistress was very sincere in her attempts, and seemed to honestly believe that her methods were correct, anyone who has ever seen dull children taught in a special school would soon see that much was left undone. One could hardly blame this on the teacher, as she had received her training solely for normal children, and although she was very definitely interested in the children's mental state, she considered them hopeless. Her main complaint was of their very bad memories and lack of concentrating power. In the first place, she was not a woman of very steady nerves, and the situation had become rather acute by the time the visit was made. Her children were yelled at too much, and they were so continually being punished that it had ceased to mean anything to them. The school room was in a constant stir, both with the children talking and the teacher yelling at them, which is hardly an appropriate atmosphere for learning. As was said before, the blame cannot be placed upon the teacher, for unless she had been especially trained or adaptable to that sort of work, it can easily be seen that the situation was not an easy one. The fact that she had lost her husband a few months before and was only sleeping every other night when she took sleeping powders probably made a very great difference in her behavior, and it is hardly fair to judge her teaching from one visit.

Most of the children had to walk up a hill a mile long to come to school, and, as nearly all went home to lunch, they made the climb twice every day. This was rather hard on some of the very young children, though they did not seem to mind, even if they did get tired. The school hours were from 9.30 to 12.30; 1.45 to 4.30, with two short play periods There were two rooms, one for infants, and one for all the other standards together. For this reason there was a great amount of individual work done, as class work with so many different ages was impossible. The teacher stayed with the older children entirely, and the infants were taught by a supple-

mentary teacher, who was a distant member of the first family mentioned, although she seemed very capable and interested.

The results of the intelligence tests of the 32 children of this school may be seen from table 1. In this specific case, it can be seen from table 1 that 14 of the children had Intelligence Quotients below 90, 3 of whom are morons, 4 borderline cases, and 7 dull. This leaves 18 out of 32 that may be considered normal. In the performance tests, 30 per cent of the children were below their Mental Age, only 15 per per cent at, or below, their Mental Age, and 20 per cent above their Real Age. In comparison with the other villages this later score is not as bad as it might be, considering the state of their mentality.

Village B, the next one visited, had an entirely different character as far as both the school and the general atmosphere was concerned. The headmistress had only had the post for a few months, so she was not so very well acquainted with village people, but as far as it was possible to find out, there was no definite intermarriage among any of the children's parents. Nearly all of the families had been there for generations, so it is not hard to imagine that there must

TABLE 1

Frequency of intelligence quotients for Burt's revision of Binet-Simon test

INTELLIGENCE QUOTIENTS	SCHOOL							TOTAL COUNTRY SCHOOLS	INSTITUTION FOR FEEBLE-MINDED
	A	B	C	D	E	F	G		
20–24									2
25–29									0
30–34									5
35–39									7
40–44									8
45–49									8
50–54						1		1	12
55–59						0		0	10
60–64	1		1			0		2	9
65–69	2	1	0			1		4	5
70–74	2	0	1	1	4	3		11	1
75–79	2	2	3	5	7	3		22	2
80–84	4	1	6	3	2	5	1	22	2
85–89	3	3	7	9	4	4	0	30	1
90–94	4	1	7	4	3	5	3	27	
95–99	6	2	11	1	2	3	2	27	
100–104	4	1	2	3	0	2	2	14	
105–109	2	2	1	1	2	0	1	9	
110–114	1	1	0	0		0		2	
115–119	0		0	1		0		1	
120–124	1		1	1		0		3	
125–129			1			1		2	
Totals....	32	14	41	29	24	28	9	177	72

have been some inter-marriages. Also, the same thing has happened here as in Village A, for most inhabitants with initiative, had left for the towns. Inter-marriage was hinted at by some of the village people, but nothing definite could be found, with the exception of one family, all of whom were supposed to be too dull to get along, even with farm work. The isolation here was just about as complete as in Village A, for there was only one bus a week, and the people in this village used that, for they did not sell to a market. Nearly all the children get to the neighboring town, about ten miles away, once a year on the Sunday School picnic, but aside from that there was no way for them to get out and see other people. A few took the cattle into the fairs once a year, but this was only a few. The people were not very friendly among themselves, for, although there were no fights, everyone "minded his own business" and did not bother about his neighbor. There was very little gossip, as they seemed afraid to talk.

The children in the school were much more quiet than the children at Village A, and were under good control. Their secretiveness was marked, as with their parents. They looked as a whole fairly healthy, and there were only a very few undernourished. They of course were very poor, as in all these places, for the set wage for farm laborers is the same, 32/6d ($7.10). The present children have been neglected by a series of uncertificated teachers. None of them has stayed long enough to understand the work, and many have not been interested in their teaching. There is only one room and one teacher for 14 children of different ages, so some classes are always being neglected to a certain extent for the sake of others. The children of this school were tested in 1926 by a doctor and a large percentage were declared mentally deficient. The school has always been noted for its dull pupils. When the present headmistress arrived, the children were found to be very nervous and scared, but she reported that they were getting over this to some extent, though some still cried very easily. Many of the boys had to help on their father's farms before they came to school and after they went home, and although this work appeared not so hard as to hurt them physically, it did take some of their strength away from their school work. Table 1 shows the record of the Intelligence Quotients of all the 14 children tested, but as in the first case, the average cannot be taken as wholly representative, due to the few numbers. In this case, of the 14 children tested, 7 were below normal, 1 of whom was a moron, 2 borderline cases, and 4 dull. This meant that half of the children in the school were mentally defective to some extent. In regard to their performance scores, 35 per cent were at or above their Mental Age; 28 per cent were below their Mental Age. Only 1 child was above his Real Age in performance.

The next village visited, C, had an entirely different atmosphere from the other two visited, although it was similar in so much as it was also a farming village and very isolated. The inhabitants seemed to have much more of a mean spirit and bad feeling toward one another than in either of

the other places. It was said later that perhaps this was due to the fact that years ago a great many Irish people had settled there, and as they were naturally fighting people, perhaps it had been handed down to this generation. This is merely a supposition, of course. Among the villagers there were very often stories of fights among the men, and sometimes among the women. Also there were very often family feuds, which generally contributed a few first squabbles every year. These people seemed to be of a wilder type than was found in the other districts. The isolation was just as complete, for there was only one bus a week, and the people could not afford to take that, so they remained in the village. The people were all fairly religious in so much as they all belonged to the church or chapel, although they did not attend frequently. Their poverty was as extreme in this case as in the others, for the wages were the same, and although a few had small holdings of their own, they barely managed to live off of them. In a few cases the children were undernourished for most of the milk and food had to be sold in order to obtain money for their clothes and other expenses, or was saved in the bank. There was an institute in a village a mile away where the men went for games at certain times. There was also an institute at the same place for women once a month for lectures, handicrafts, etc. The headmistress said that this had made quite a difference among the people. There was still a strong belief in witchcraft among the parents of the children, and on one case a woman threatened another woman and blamed her for "overlooking" her child and causing her to have scarlet fever. There was also a case in the village of a girl very earnestly believing that she had been cured by a witch doctor in the nearest city. Although the children themselves had not as yet shown signs of beliefs such as these, having it so firmly planted in their environment these beliefs probably influenced their responses.

The school itself is comprised of 47 children, two school rooms with one headmistress and one assistant, the latter not being very well trained. The headmistress was exceptionally good, and realized what she faced in trying to teach most of her pupils. If the children do work for scholarships and receive them, their parents will not let them go, for they do not like for them to leave home. None of the children had seen the sea until they were taken by the headmistress when she first came. A trip has been made every year since. Some of the children were so very shy that they often did not even speak or answer the headmistress after being in school as long as three months. There were three of this type present when the tests were given, and it was impossible to find any way to make them answer. They were so dreadfully frightened of a stranger that all they would do was to cry. Many of the children had to walk as far as two and a half miles to school, all of it hilly. The headmistress tried to get the committee to bring the little ones to school every morning, that way eliminating their climb up the hill, but they would not do it. Many of the older boys helped

with the farms before and after school, and in hay-making time they often worked until eleven or eleven-thirty at night. The school hours were from 9.30 to 12.30; 1.30 to 4.00. This early closing was made so that many of them could get home in the winter before dark.

The children under the headmistress were taught exceptionally well as she had been a trained teacher with experience before she took this post. She had nearly all individual work because of the differences in the ages, and the children that definitely could not learn, she allowed to concentrate on more manual tasks. The average Intelligence Quotient of the school was not very low, as can be seen from table 1, for there were a few fairly bright children, but there were also quite a few even below the dull mark which were a problem both for the village and school. In this case there were 18 out of 41 children who were defective, 1 of whom was a moron, 4 borderline cases, and 13 dull. In this school also, almost half of the children were definitely below normal in intelligence. In their performance tests, 48 per cent were below their Mental Age, 12 per cent at or above it, and 10 per cent about their Chronological Age. This school was lower in its performance scores than any of the previous ones.

The case was very nearly the same in Village D, for they were only 1 mile apart, and the character of the villagers were somewhat alike. There were 30 children on the roll when the tests were made. There used to be many more, but the village had gone down a great deal. There was a village hall where the institute holds its meetings, and also a Public House. The children went to a neighboring town once or twice during their vacations, and also, they had one or two outings a year when they get away from the village. Although this village is only one mile away from the other, the people were of a different nature in so much as they were friendly. There is none of the fighting or feudal feeling that there was in the other place. The mothers seldom come to the school, so the headmistress really knew very little about the village life. Most of the fathers were farmers or farm laborers as in the case of the other villages, but there was more central feeling as the village was larger and they live nearer to one another.

As for the school, there were 2 rooms, with 1 teacher and 1 helper for the infants, the latter being only a young country girl with elementary education. The headmistress tried to bring the children out of the infants' room as soon as possible so as to be able to teach them herself. The children were quiet and easy to control and seemed quite interested in their work, this being mainly due to the teacher's good methods. Many of the boys have to work on the farm before they come to school, but none of them does so much work that they have to get up before seven. There has been no direct inter-marriage of cousins among the children's parents, which was the same case as the former nearby village tested, but in both cases there had been a great deal of this in former times. Most of the children had to walk from one to two and a half miles to school, but quite a number of them stayed for

lunch, so the distance they walked was not so very great. Although the mean Intelligence Quotient was a point lower in this case than in the neighbouring village, the extremes did not seem to be as great, although the headmistress seemed to consider some of the lowest impossible to teach. In this case, 18 out of 29 children were mentally deficient, which is a very great percentage. Of these, 6 were borderline cases, and 12 were found to be dull. In their performance tests the percentage below and above the normal mental age was 24 per cent in each case. There were 20 per cent with mental ages above the normal and this is the highest score received by any of the schools.

The next village, D, was about the most depressing and hopeless of them all. Not only were the children duller, but their poverty seemed to be more extreme. Many of them were in rags, and although only 2 of the 26 tested were reported as undernourished, they all looked rather poorly fed. The schoolmistress was a village girl that had received her certificate while teaching in another country school, and had come here as headmistress to be able to live at home. As she was a native of the village the material that could be obtained about the inhabitants was so definitely biased that it was of no use, so a visit was made to the vicar who was very considerate and helpful. Although he knew of no marriage of first cousins in this district for years, he said that there had been a great deal of intermarriage due to the fact that no new people had come in to live, and that the opportunity for marriages was very limited. This village was written about in one of Blackmore's novels, and at that time was very wild, so a great improvement had taken place, although much more was needed even at present. The vicar's main complaint was that the village people did not have enough connection with the outside world. Although there were two busses a week to the nearby town and one once a month to the nearest city, very few of them ever left their own homes. He had worked for a telephone for the post office for years, and had finally succeeded a few months before to get one installed. It had helped quite a good deal as far as obtaining a doctor was concerned, but of course it had had no beneficial effect upon getting the people out of their narrow lives. Among the older people there was still a great belief in the witch doctor, "overlooking," the evil eye, etc. The vicar knew a man who died two years before because he was positive he had been "overlooked" and no one could convince him otherwise. He had believed that a man in the village had power to cure him although he was not a regular witch doctor.

The school consisted of about 29 children generally, with two rooms, one teacher and a helper for the infants' department. The headmistress appeared to be a fairly capable teacher, only she did not realize the low intelligence of her pupils. There were quite a number of her relatives in the class who were just as dull as the rest. She was willing to admit that none of them was brilliant, but she really believed that they were of good average intelligence. The school

hours were 9.15 to 12.15; 1.30 to 4.00. Most of the children had to walk from one to two miles from home to school, but they stayed at the school for lunch. The average child gets into the small neighbouring town only about once a year, if that frequently. The results of the tests were rather drastic, for only one child out of the 26 had an Intelligence Quotient of 100 or above, the lowest starting at 70. When one considers that these children have no hope of ever getting away from their present environment, and that they will probably marry each other, the situation becomes more acute. The school was not a great help, as their teacher was of the same sort, although of course not low mentally, but as far as finding any connection with the outside world through their school, the children are absolutely helpless.

In this school, 17 out of 24 were mentally defective, and only one child had an Intelligence Quotient of 100 or above. Of the defective ones, 11 were borderline cases, and 6 were dull. In performance, the scores were correspondingly low, as 50 per cent were below their mental age and only 16 per cent at or above it, and 2 children above their real age.

The next two villages visited, E and F, can best be described together, for they were similar as far as the type of children attending the schools was concerned. Although both of these villages were populated by farms, as in the other cases, there was an entirely different type of person there. They were both situated in the hills, about a mile up from the better farming land, so the people there were very generally poor farmers and could not hold on to their good land, or they had been people who could not get along with the others, and had had to move away. They were very quarrelsome and bothered the school work a great deal, particularly in school E. In this case, the present headmistress was the only one that the school had ever had who had got along well with the people. She managed by always laughing when they came to her with complaints. The people themselves did not get along together at all well, for the villages were full of petty jealousies. They would not even attend Jumble Sales at the schools, for one woman would not come if another brought anything. There were no busses to the neighboring towns or cities and many of the families never left the villages, quite a number of whom had children in the schools. There was no social life at all, for, although many of them were related, they did not like one another. There was a Public House in Village E, but there was not much drinking for there was no money. All the families had intermarried a great deal, and although none of the children had parents who were first cousins, the stock had been weakened a great deal, both by the general inter-marriage and by the best children leaving for the town when they grew up. In a talk with the vicar, who had resided there for thirty years, it was found that he had a very strong dislike of institutions, and boasted that since he had been there he had kept as many as 20 children from being sent to a nearby institution which happened to be the institution in which tests were given. He believed that they were better off with

their parents! He also showed his extreme narrow mindedness by not believing in higher education for girls, but this did not affect his parishioners to a great extent as none of them was capable of getting very far in education.

The two schools were not as much alike as the villages, so they will be dealt with separately. School E had about twenty-nine children ordinarily, but at the time of the testing several were away helping their fathers with the hay-making. The headmistress complained a great deal about the amount of work her pupils had to do at home, for she thought it was too hard for them, and that it took too much strength from their class work. The farms were too poor to afford any paid help, so the oldest boys generally had to do all the work that their fathers could not manage to get done. Many times they had to stay away from school for this. The school hours were from 9 to 12; 1 to 3.30 and many of the children had to walk as far as two and a half miles to come in the morning, after working hard on the farm. The children looked fairly healthy, but the headmistress believed that quite a number of them did not get enough of the right sort of food. Her main trouble with them was to get them to concentrate, for she said that unless she kept them at attention all of the time, their minds wandered dreadfully. She had taught two years in an open air special school, so she was particularly well trained for this position. She realized what she faced in the way of mentality, and did the most she could do. There were two rooms, and she had a fairly capable teacher for the infants. The school seemed to be very well run, and although the children were talkative, they were kept in good order. In the school 18 out of 28 were defective, 2 of whom were morons, 6 were borderline cases, and 10 were dull. In this case again over half of the school was below normal in its intelligence. The performance scores show that none of the children are at or above the average or normal score and 50 per cent are below.

School F was very much smaller, only 9 children, 2 of whom were children of the headmistress. The school had been much larger, but due to a fight over the church's grazing ground, one of the largest families declared that the vicar had an "evil eye," and that they would not have their children in a cursed school, so they removed them to School E. The firm belief in witching was found in both of these villages more than in the better farming districts. Needless to say there was only one school room for all the children, and one teacher. She had taught in city schools, and seemed a capable teacher. Although the tests showed that there was only one child below 90, who could really be called dull, she despaired of their intelligence, and thought they were extremely hard to teach. Although her class was small, she worked hard and was conscientious about all their subjects. The children all looked healthy, and in general, seemed to be a better class of children than in School E. The headmistress seemed to think that she had got rid of her worst ones when the family had the fight with the vicar. The school hours were the same as for

School D, and the distances approximately as far. The children were under good control, and appeared to be interested in their work. As there were only 9 children attending this school it is not a very convincing example, for the 9 attending are of fairly high intelligence in comparison with the others. Only one child could really be called dull, but also, only 2 children reached the Intelligence Quotient of 100, and one of these was the child of the headmistress.

In the Goodenough "drawing-a-man" test the percentage of children at or above the norm in the institution of the same in the country schools combined. This perhaps might be due to the training at the institution, which necessarily includes more activity similar to the performance tests, as they are catering to a whole group of mentally deficient, and do not have to include all the other subjects that must be taught in regular elementary schools.

TABLE 2

Frequency of mental ages for performance tests

PERFORMANCE MENTAL AGE	SCHOOL							TOTAL COUNTRY SCHOOLS	INSTITUTION FOR FEEBLE-MINDED
	A	B	C	D	E	F	G		
years									
Below 8	14	6	14	12	9	22	4	81	43
8	5	2	7	3	7	2	1	27	7
9	4	5	11	5	3	1	3	32	10
10	3	1	5	5	5	3	1	23	8
11	1	0	1	2	0	0	0	4	2
12	4	0	0	0	0	0	0	4	1
13	0	0	0	1	0	0	0	1	0
14	1	0	1	0	0	0	0	2	1
15	0	0	0	1	0	0	0	1	0
Totals....	32	14	39	29	24	28	9	175	72

From table 2, the results of the performance tests of both the institution and the school can be seen and compared. There seems to be no reason why the percentage of children above their real age in performance should be better in one school than another. Taking all the country schools together, the largest percentage seem to be below normal mental age in performance tests. The percentage of institution children at or above the normal mental age was noticeably higher than the percentage is very much higher than the same in the country schools. As the test is not supposed to depend on training, this can hardly be explained in the same manner as with the performance scores. The children obviously forget all they have learned about drawing when they are asked to draw a man from memory. Anyway, there is adequate attention given to drawing in the regular schools. The number of children among the normal schools who are below their mental age in this drawing test is even more alarming

when you consider how low some of the mental ages are below their real ages. Being able to draw a man is one test of intelligence, and so this shows just how backward these children are as a whole.

The institution tested was a fairly large one, devoting a great deal of time to the training and keeping of certified mentally defectives. The 72 cases that were tested in this research were education cases, *i.e.*, those sent there by organizations and schools for special training until they were 16. Most of the class work was carried on by trained nurse-teachers, and supervised by a very well trained headmistress and headmaster. Some domestic training for the girls was emphasized, and some of the boys learned trades, though in general, for these cases, most of the work was scholastic as far as possible. The children seemed very happy, although an institutional air prevaded, as it always does, no matter how much attempt is made to keep from it. The place was very friendly to research workers, and was extremely interested in any new material that might help them in their work. It seems to be a well managed place and

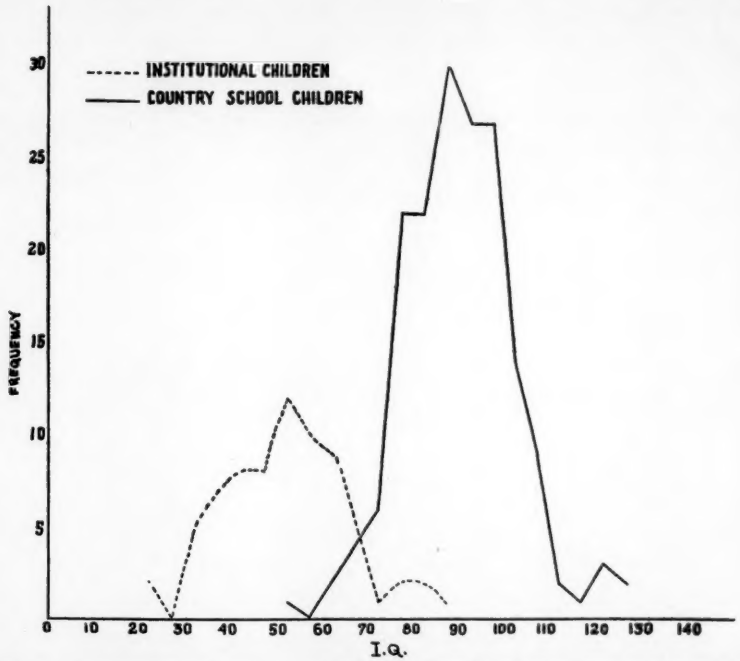

FIG. 1. FREQUENCY OF INTELLIGENCE QUOTIENTS FOR BURT'S REVISION OF BINET-SIMON TEST, COMPARING INSTITUTIONAL AND COUNTRY CHILDREN

deserves credit for a great deal of hard work. If quite a number of the dullest cases in each village school tested would be allowed to be sent here, there would probably be a great improvement in their attainments, for a place well equipped for special children would seem to give them better training than a headmistress that has not the time or training. Of all the children tested here, one was an idiot, 29 imbeciles, 36 morons, 3 borderline cases, and 3 were found dull.

Intelligence Quotients of the combined village schools illustrated in figure 1 shows that 92 of the 169 rural children that were tested were mentally deficient, the mean Intelligence Quotient being about 89. The correlation between the Intelligence Quotients and the performance scores is .618 which shows a tendency toward a similar group ranking for both forms of tests.

The results show the condition both of the villages and schools in isolated pockets of the county and the effect upon the mental development of the children. The influence of inbreeding also appears to be a highly contributing factor in mental deficiency and in emotional instability.

An Analysis of the Literature Dealing With Nursery Education

DOROTHY E. BRADBURY AND ESTHER LEECH SKEELS

ONE of the values of bibliographical research is that it may indicate certain trends within a field. With this in mind an analysis was made of a bibliography of nursery school education published by the National Association for Nursery Education covering material appearing up to December 1934 (2). Eight hundred forty references comprise the bibliography.

It includes publications dealing specifically with nursery school education and published in the United States, with as many from English as could be identified. No attempt was made to include references written in languages other than English. The distribution according to publication dates is as follows:

Year	*Publications issued*
1919	2
1920	3
1921	1
1922	9
1923	16
1924	15
1925	49
1926	51
1927	62
1928	104(92)
1929	88
1930	93
1931	102
1932	90
1933	95
1934	60*
Total.....	840

* Eleven months.

The total of 104 in 1928 is somewhat misleading in that it is largely due to the fact that the individual chapters of the Twenty-Eighth Yearbook of the National Society for the Study of Education on *Preschool and Parental Education* (3) were listed separately. Twelve of the references issued in 1928 can be accounted for in this way. Only eleven months of 1934 are included. The low level of this year can be partially explained by the fact that some of the magazines containing the most references on nursery education are quarterlies which normally appear in December, namely Child Development, Progressive Education, Pedagogical Seminary and Journal of Genetic Psychology, and Journal of Experimental Education.

Only six publications were issued prior to 1922; whereas 50 per cent of the material has been published since 1929. This fact indicates the momentum with which the field of nursery education has developed.

The following individuals are each credited with five or more publications in the field.

Individual	*Publication*
Davis, Mary Dabney.....	18
Gesell, Arnold L.....	16
Stoddard, George D.....	15
Woolley, Helen T.....	15
Goodenough, Florence L.....	12
Johnson, Harriet M.....	10
McMillan, Margaret.....	10

Individual	*Publication*
Langdon, Grace	10
Alschuler, Rose H.	9
Meek, Lois Hayden	9
Earle, Rebecca K.	8
Hill, Patty Smith	8
Foster, Josephine C.	7
Eliot, Abigail A.	6
Harley, C. Winifred	6
Kawin, Ethel	6
Updegraff, Ruth	6
White, Edna N.	6
Anderson, Harold H.	5
Anderson, John E.	5
Baruch, Dorothy W.	5
Christianson, Helen M.	5
Conrad, H. S.	5
Hulson, Eva L.	5
Jersild, Arthur T.	5
Koch, Helen Lois	5
Manwell, Elizabeth Moore	5
Vance, Thomas F.	5
Wellman, Beth L.	5

The classification used in the bibliography together with the number of references in each category is listed:

Classification	*References listed*
Viewpoints and Philosophy	56
Survey	393
Historical Development	29
Present Status	60
Conference Reports	32
Comparison of Nursery Schools With Other School Levels and Institutions	14
Description of Nursery Schools.	196
In America	160
In Colleges, Universities, and Training Schools	70
In Independent Research Centers	18
In Public Schools	19
In Private Schools	6
In Coöperative Nursery Schools	21
In Independent Private Nursery Schools	8
In Social Welfare Agencies For Handicapped and Sick Children	15
	3
In Foreign Countries	36
Contribution of Nursery Schools	55
Biography of Leaders	4
Bibliography	3
Nursery School Organization and Administration	11
Housing	4
Budgets	1
Schedules	2
Records	4
Nursery School Procedures	126
Underlying Principles	20
Health	10
Nutrition	5
Clothing	5
Teaching Techniques	4
Habit Formation	6
Mental Hygiene	4
Personality Problems	10
Play and Play Equipment	23
Science Experiences	4
Children's Literature	8
Music	5
Art	3
Parent Education	19
The Nursery School as a Training Center	21
Preparental Education	6
Preparation of Teachers	13
Preparation of Nurses	2
Research in Nursery School Education	233
Research Techniques	22
Attendance	5
Measurements	31
Intelligence	10
Personality	21
Physical Development	6
Health and Nutrition	6
Motor Development	4
Mental Development	52
Sensory	5
Imagination	1
Learning and Problem Solving	26
Comprehension	2
Language	18
Habit Formation	27
Emotional Development	10
Social Development	29

Play	12
Art, Rhythm, and Music	18
Social Background	3
Comparison With Non-Nursery School Children	2
Teaching	3
Possibilities for Research	9
Grand Total	840

In analyzing the component parts of the outline used in the bibliography some interesting information was obtained. Under the category *Description of Nursery Schools*, the following distribution according to years resulted.

Year	*Publications issued*	*Per cent of total issued during year*
1922	2	22
1923	10	62
1924	3	20
1925	21	43
1926	12	24
1927	20	32
1928	23	22
1929	24	27
1930	18	19
1931	19	18
1932	17	19
1933	17	18
1934	9*	15*

* Eleven months.

From the above tabulation it is apparent that the proportion of descriptions of nursery schools in relation to the total number of publications dealing with nursery education issued during a given year has tended to decline since 1923, although the proportion has fluctuated from time to time. The first article classified purely as a description of a nursery school was issued in 1922; this reference is antedated by the book edited by Grace Owen *Nursery School Education* (4) which, although primarily concerned with the philosophy of nursery education, does include descriptions of specific nursery schools.

In sharp contrast with the above distribution of publications, is the distribution of research[1] references given below.

Year	*Publications issued*	*Per cent of total issued during year*
1924	1	6
1925	3	6
1926	4	8
1927	6	9
1928	28	26
1929	14	15
1930	29	31
1931	35	34
1932	45	50
1933	50	52
1934	17*	28*

* Eleven months.

If the incomplete returns for 1934 are discounted, there is a steady increase in the proportion of research articles as compared to the total number published. The first article that can be classified as a research in nursery education appeared in 1924 and was issued by Andrus (1). The number of references falling under the category of research indicates how the activities of the nursery school program are being analyzed and evaluated.

The following tabulation shows the magazines containing the greatest number of articles. No magazine is listed that did not contain five or more articles.

[1] In this classification a research was considered one in nursery school education if it dealt with or had a definite bearing on nursery school procedures or the effect of nursery school practice upon the child. No attempt was made to include all the researches in the field of child development in which nursery school children were used as subjects

Magazine	*Articles*
Childhood Education	123
Child Development	60
American Childhood*	41
Pedagogical Seminary and Journal of Genetic Psychology	31
School and Society	21
New Era	20
Progressive Education	20
Journal of Home Economics	18
School Life	10
Genetic Psychology Monographs	10
Journal of Experimental Education	10
Survey	9
School and Home	9
Child Health Bulletin	9
Addresses and Proceedings of the National Education Association	7
Scottish Educational Journal	7
Public Health Nurse	7
Mother and Child**	7
Times Educational Supplement	6
Parents' Magazine	6
Practical Home Economics	6
Journal of Juvenile Research	6
Child Study	6
Journal of the National Education Association	5
Hygeia	5

* Formerly Kindergarten and First Grade.

** No longer issued.

Childhood Education is apparently the best single source for material dealing with nursery schools. Although a much younger magazine than Childhood Education,[2] Child Development is credited with nearly half as many references. Whereas the material appearing in Childhood Education deals largely with philosophy and educational procedures, Child Development reports only research studies.

Publications concerning the present movement for educating young children, the so-called nursery school movement, began to appear in 1919, although 50 per cent of the material has been published since 1929. Two trends in the field seem to be interrelated: descriptions of nursery schools as such have tended to disappear as the movement advanced, whereas researches have increased markedly. If these tendencies continue in the future, the time should be close at hand when nursery schools can be evaluated on an objective basis.

[2] Childhood Education was first published in 1924. The first issue of Child Development did not appear until 1930.

REFERENCES

(1) ANDRUS, RUTH: A tentative inventory of the habits of children from two to four years of age. Teach. Coll., Columbia Univ., Cont. to Educ., 1924, No. 160, pp. 150.

(2) BRADBURY, DOROTHY E.; SKEELS, ESTHER LEECH; and SWIEDA, WANDA: Nursery School Education: A classified and Annotated Bibliography including references published up to December, 1934, Boston, Mass. (Abigail A. Eliot), 147 Ruggles St., 1935, pp. 133.

(3) National Society for the Study of Education: 28th Yearbook of the National Society for the Study of Education: Preschool and Parental Education. Part I. Organization and Development. Part II. Research and Method. Bloomington, Ill., Public School Publishing Co., 1929, pp. x, 875.

(4) OWEN, GRACE (Editor): Nursery School Education. New York, Dutton, 1920, pp. 176.